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THESIS

LEVERAGING POISON CENTERS' CAPABILITIES FOR HOMELAND SECURITY

by

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December 2015

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13. ABSTRACT (maximum 200 words)

Despite a nationwide presence, the daily provision of toxicologic emergency care and collaboration within the public health and emergency management arena, the nation's poison centers are underutilized as a resource and as a partner for homeland security. The lack of utilization has clinical and monetary implications across the healthcare and public health enterprise. This thesis investigated the question do poison centers improve outcomes during public health emergencies? If so, how can they be better leveraged? This thesis research includes a case study analysis evaluating five functions that poison centers provide: disaster response, situational awareness around emerging threats, communication of these threats to the general public and to health care responders, clinical expertise and reducing the burden on health care facilities by preventing unnecessary emergency department visits, and reducing hospitalized patient's length of stay. The findings of this research demonstrate that poison centers do positively impact outcomes during a disaster. They save lives, reduce health care costs, and provide a unique and valuable resource to the public and professional community. In order to better leverage these capabilities recommendations based on this research, collaboration should be increased with the Department of Homeland Security, Health Resources and Service Administration, and the Center for Disease Control, as well as with local and state agencies engaged in emergency response efforts.

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LEVERAGING POISON CENTERS' CAPABILITIES FOR HOMELAND SECURITY

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ABSTRACT

Despite a nationwide presence, the daily provision of toxicologic emergency care and collaboration within the public health and emergency management arena, the nation's poison centers are underutilized as a resource and as a partner for homeland security. The lack of utilization has clinical and monetary implications across the healthcare and public health enterprise. This thesis investigated the question do poison centers improve outcomes during public health emergencies? If so, how can they be better leveraged? This thesis research includes a case study analysis evaluating five functions that poison centers provide: disaster response, situational awareness around emerging threats, communication of these threats to the general public and to health care responders, clinical expertise and reducing the burden on health care facilities by preventing unnecessary emergency department visits, and reducing hospitalized patient's length of stay. The findings of this research demonstrate that poison centers do positively impact outcomes during a disaster. They save lives, reduce health care costs, and provide a unique and valuable resource to the public and professional community. In order to better leverage these capabilities recommendations based on this research, collaboration should be increased with the Department of Homeland Security, Health Resources and Service Administration, and the Center for Disease Control, as well as with local and state agencies engaged in emergency response efforts.

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LIST OF ACRONYMS AND ABBREVIATIONS

AAPCC	American Association of Poison Control Centers
AFHSC	Armed Forces Health Surveillance Center
ACMT	American College of Medical Toxicologists
CDC	Center for Disease Control
CSPI	Certified Specialist in Poison Information
DOD	Department of Defense
EPA	Environmental Protective Agency
EARS	Early Aberration Systems
EMR	electronic medical record
EMS	emergency medical service
EPIX	Epidemic Exchange Network
FDA	Federal Drug Administration
DMX	dextromethorphan
GPHIN	Global Public Health Intelligence
H1N1	human influenza A
HCF	health care facility
HCP	health care provider
HRSA	Health Resources and Service Administration
HSPD	Homeland Security Presidential Directive
ICD	International Classification of Disease
IOM	Institute of Medicine
LOS	length of stay
MERS	Middle East Respiratory Syndrome
NCHPC	National Clearing House for Poison Centers
NPDS	National Poison Data Service
OTC	over the counter medications
PHI	public health information officer
PROTECT	Preventing Overdoses and Treatment Exposure Task Force
PSA	public service announcement

RADARS	Research, Abuse, Diversion and Addiction Related Surveillance
REAC/TS	Radiation Emergency Assistance Center/Training Site
TESS	Toxic Exposure Surveillance System
TTDY	telecommunications/teletype communications for the deaf
WHO	World Health Organization
WIC	Women Infant and Children
WMD	weapons of mass destruction

EXECUTIVE SUMMARY

Despite a nationwide presence, the daily provision of toxicologic emergency care, collaboration within the public health and emergency management arena, and significant contributions to health care that have spanned more than 50 years, the nation's poison centers are underutilized as a resource and as a partner for homeland security. The lack of utilization has clinical and monetary implications across the healthcare and public health enterprise. This thesis investigates whether poison centers improve outcomes during public health emergencies, and if so, how they can be better leveraged.

From the literature search conducted, case studies and research were evaluated, and they demonstrated both effectiveness of poison center utilization during emergencies and inherent limitations. Knowledge of poison center's function, scope of services, and clinical expertise is not widely known within the homeland security expertise. Cases studies and examples that demonstrate these capabilities were analyzed.

Although individual poison centers vary somewhat in their capabilities, this analysis considered all poison centers in the country collectively. Poison centers not only have a shared mission but each of the 55 recognized poison centers work collaboratively and are aligned through their membership organization: the American Association of Poison Control Centers (AAPCC). Poison centers also attain accreditation through the AAPCC and as such must meet an accreditation criterion that is standardized across all centers.

The analysis for this thesis is centered on five of the core functions that poison centers provide nationwide: (1) disaster response efforts; (2) the provision of situational awareness around emerging threats; (3) communication of these threats to the general public and to health care responders; (4) provision of clinical toxicologic expertise; and (5) reduction of resource burdens on health care facilities by preventing unnecessary emergency department visits and reducing hospitalized patient's length of stay.

The results demonstrated benefits to using a poison center during an emergency. These benefits include: (1) faster response time in the identification of a toxin; (2)

development of a treatment plan; and (3) dissemination of critical information to the general public and all public and health care responders. Poison centers' efforts help to prevent emergency departments being overwhelmed with patients by providing clinical triage and health information over the phone. In addition, the research shows case studies in which early identification of an emerging trend was detected by poison center staff and responders were able to initiate efforts towards containment because of their toxicosurveillance capabilities.

The results of this analysis suggest that to contribute more effectively to disaster response, poison centers must promote what they have done and can do in a disaster. The AAPCC and individual centers themselves need to partner with relevant homeland security and other officials to develop a strategic plan to fully utilize poison centers' capabilities in public emergencies. These strategies should include: (1) the expansion of collaborations with nontraditional partners, including those outside of healthcare; (2) the provision of surveillance around all chemical, biological, radiological, nuclear, and explosives (CBRN) threats; and (3) the active engagement in disaster response and planning efforts.

For there to be an impactful change as to how poison centers' capabilities are integrated into disaster response efforts on a local, state and national levels during a disaster, these strategizes need to be adopted by all poison centers within the AAPCC membership. To implement these strategies, specific tactics will be required at the local, state, and national levels. These tactics should include enhancing their local and state presence by: (1) allowing centers to have access to health care facilities' electronic medical records, and (2) the participation in local and state disaster drills.

On a national level the tactics should include: (1) maintaining centers' existing relationship with Health Resources and Services Administration; (2) the ongoing promotion of the national Poison Helpline's public awareness campaign to include target audiences, such as law enforcement, emergency medical services, and public health professionals; (3) build on the current relationship with the Centers for Disease Control (CDC) around toxicosurveillance to include surveillance and support not just with

pandemic flu and Ebola but other public health concerns; and (4) develop a more formal and collaborative relationship with the Department of Homeland Security (DHS) and more specifically with the Federal Emergency Management Administration (FEMA).

Our nation is confronted by threats that are either manmade or naturally occurring on a daily basis. Vigilance is needed to plan for, detect, respond to, and mitigate the effects of these threats. Poison centers do this on a daily basis. It is in the best interest of our communities to leverage the demonstrated expertise of our poison centers in order to enhance existing disaster response efforts. We need to do this is order to better safeguard the well being of all of us.

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And to Jack, my grandson, you are my inspiration. It is for you and your generation that I hope all of our efforts will help to make this world a better and safer place for you to live.

I. INTRODUCTION

Despite a nationwide presence, the daily provision of toxicologic emergency care, and some collaboration within the public health and emergency management arena, the nation's poison centers are underutilized as a resource and as a partner for homeland security. A poison center's overall function according to the World Health Organization (WHO) is to "prevent, identify and provide management guidelines on poisonings" either through phone consultation, treatment centers, or laboratory services.[1] The research presented in this thesis focuses on the implications of not fully engaging poison centers during a disaster and the resulting clinical and monetary implications across the healthcare and public health enterprise.

During the course of the last 50 plus years, countries throughout the world have established poison control centers in response to the growing public health concern about poisonings.[2] The World Health Organization reported that over four percent of the world's deaths were due to poisonings.[3] These deaths are due in part from exposures to pesticides, chemicals, and radioactive material from nuclear power plants. These chemical incidents are the results of manmade errors, acts of terrorism, mechanical malfunctions, and natural disasters. In the United States, poisonings account for the majority of the injury related deaths that occur. In this country, these deaths are largely attributed to the ingestion of prescription, over the counter, or illegal drugs.[4] The American Association of Poison Control Centers 2013 annual report states poison centers

[1] "International Programme on Chemical Safety-Poisons Centres," World Health Organizations, accessed June 8, 2015 http://www.who.int/ipcs/poisons/centre/en/.

[2] Ali Pourmand, Justin Wang, and Maryann Mazer, "A Survey of Poison Control Centers Worldwide," *DARU Journal of Pharmaceutical Sciences* 20 (2012): 1, DOI: 10.1186/2008-2231-20-13.

[3] "International Programme on Chemical Safety-Poisons Centres," World Health Organizations.

[4] "NCHS Data on Drug Poisoning Deaths," Center for Disease Control, June 2015, accessed November 5, 2015, www.cdc.gov/nchs/data/factsheets/fact_drug_poisoning.pdf.

provided management recommendations for over two million poisonings, of which 1500 patients died.[5]

Poison centers may vary in the services that they provide, how they are staffed, and in their funding methods, but they do have the unifying mission of reducing the cost, severity, and morbidity associated with poisonings.[6] They also have the shared responsibility of playing a key public health role within their communities. One aspect of this role is that of toxicosurveillance or toxicovigilance. This is the early identification of emerging threats to a city, state, or country. Tangential to this role is that of providing evidence based management guidelines in response to these threats to health care providers and responders.[7] These threats may be natural or manmade.

A. PROBLEM STATEMENT

We are living in a time when public expectations are that health care, public health, and government agencies will respond quickly and with expertise during a crisis. Posion centers have a long history of providing clinical expertise during emergencies. They are, however, often times overlooked or engaged late in the course of a diasster. Their toxicosurviellance efforts provide for early recognition of biological, chemical or radioactive threats,[8] such as with Ebola, influenza, carbon monoxide exposures after Hurricane Sandy or countless other examples.[9] This early recognition sets the stage for a quick response and deployment of assistance and resources as well as better public health and community outcomes.

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[5] James B. Mowry et al., "AAPCC 2013 Annual Report," *Clinical Toxicology* 52, no. 10 (2014):1038, 1055, DOI: 10.3109/15563650.2014.987397.

[6] The Lewin Group, *Final Report on the Value of the Poison Center System*, 2012, https://aapoisoncenters.s3.amazonaws.com/pdfs/memberresources/Value_of_the_Poison_Center_System_FINAL_9_26_2012_--_FINAL_FINAL_FINAL.pdf, 1.

[7] "International Programme on Chemical Safety-Poisons Centres," World Health Organizations.

[8] *National Poison Data System, NPDS Coding Users' Manual*, American Association of Poison Control Center, 2014, https://aapcc.s3.amazonaws.com/pdfs/member-resources/NPDS_Coding_Users_Manual_v3.1_07May2014.pdf, 5.

[9] "National Poison Data System," American Association of Poison Control Centers, accessed June 5, 2015, http://www.aapcc.org/data-system.

B. THE RESEARCH QUESTION

Can poison centers improve outcomes during public health emergencies? Is so, how can they be better leveraged to meet homeland security needs? This question was researched as it relates to poison center activities at local, state, and national levels during incidents resulting from manmade and naturally occurring events. Also considered were barriers to utilizing poison centers in this capacity.

C. BACKGROUND

The following paragraphs provide background information on how poison centers are structured as well as their evolving scope of function in order to establish a basic understanding of their capabilities and how these capabilities are applicable during a disaster. Review of the literature and empirical data suggests that recognition and appreciation for poison center's capabilities are limited.

Currently, there are 55 poison centers across the United States and U.S. territories[10] that provide 24/7 triage response to over four million calls annually.[11] The first poison center was started in Chicago in 1953,[12] and by 1970, over six hundred poison centers had been established nationwide.[13] In response to a growing numbers of pediatric deaths related to poisonings, the number of poison centers rose to 661 by 1978. These centers are staffed with professionals from a variety of health care and education professions that are trained in some aspect of toxicology.[14]

Concurrent with the development of poison centers was the development of a national data collecting agency: the National Cleaning House for Poison Centers

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10 "About," American Association of Poison Control Center, accessed September 4, 2013, http://www.aapoison centers.org/about/.

11 The Lewin Group, *Final Report on the Value of the Poison Center System*, 1.

12 Institute of Medicine Committee on Poison Prevention and Control Board on Health Promotion and Disease Prevention, *Forging a Poison Prevention and Control System* (Washington, DC: National Academies Press, 2004), 81.

13 Ibid., 24.

14 M. A. Kostic, S. Rutherfoord-Rose, and Vikhyat S. Bebarta, "Understanding Poison Control and Protecting It's Future," *Pediatric Annals* 34, no 12 (2005): 984.

(NCHPC). The NCHPC was a department within the Food and Drug Administration FDA. Also established early on in the evolution of poison control centers was the American Association of Poison Control Centers (AAPCC). There were limitations found with the NHCPC as it had no formal relationship or ownership over poison control centers and no mandating reporting[15]

During the 1980s and 1990s poison centers began to collaborate and refine their services under the direction of AAPCC. The AAPPC serves to provide support to the staff of poison centers through representation and partnership with other healthcare, nonprofit, and government agencies charged with reducing the number of poisoning, fatal outcomes as well as serving as the accreditation body for poison centers and for certification of poison center staff. In addition, the AAPCC manages its membership's public relations activities, continuing education efforts, and toxicosurveillance efforts.[16]

The first foray on the part of poison control centers into data collections was a paper-based system named the Toxic Exposure Surveillance System (TESS), initiated in 1983.[17] By 1996, this system was capturing 87 percent of all of the poisonings that were occurring nationwide.[18]

The 2000s brought additional changes to poison control centers through the Poison Control Center Enhancement Act of 2000. This act called for supplemental funding to centers in order to enhance their current public and professional outreach education, the refinement and expansion of a toxicosurveillance system, stabilization of poison centers at risk for closing because of a lack of funding, and the establishment of a national effort around poison prevention education.[19] This act, signed into law by President Clinton, forged a partnership between the AAPCC, the Health Resources and

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[15] Institute of Medicine Committee, *Forging a Poison Prevention and Control System*, 83.

[16] Ibid., 88.

[17] Ibid., 90.

[18] Toby Litovitz, "The Tess Database, Use in Product Safety Assessment," *Drug Safety* 18, no. 1 (1998): 10.

[19] Lewis R. Goldfrank, "Call Centers, Disaster Medicine, and Public Health Preparedness," *Disaster Medicine and Public Health Preparedness* 3, no. 3 (2009): 136, DOI: 10.1097/DMP.0b013e3181b9dbaa.

Services Administration (HRSA), and the Center for Disease Control (CDC). Success of this partnership includes the initiation of a national poison prevention awareness campaign and the development of one national 800 number for professional and public access.[20] There have been some additions to the Poison Control Center Enhancement Act over the years including the 2003 amendments to the act, which included the recommendation that the public utilize poison control centers for information on chemical, nuclear, and biological threats.[21]

1. Clinical Expertise

A poison center, in order to meet accreditation criteria must be staffed by physicians who attained board certification in medical toxicology; similarly pharmacists must attain certification in clinical toxicology, and a mix of physicians, registered nurses and pharmacists must be certified as specialists in poison information (CSPI). Poison centers are also staffed with public health educators.[22] Their rolls, while different, do overlap to provide a comprehensive approach to managing a poisoned patient.

The majority of staff working in a poison center are CSPIs. It is their role to respond to the emergency hotline and quickly assess the need for medical attention when someone has been exposed to a toxin. If the CSPI is a registered nurse, his or her clinical background prior to working in a poison center often includes emergency or intensive care nursing experience. If she or he is a pharmacist, it may include experience working in a hospital based clinical setting.

2. Staff Certification

Attaining certification as a CSPI requires that the staff person pass a national certification exam administered by the AAPCC. This exam is given annually to anyone

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[20] *Poison Control Center Enhancement and Awareness Act*, 2000, Government Printing Office, http://www.gpo.gov/fdsys/pkg/STATUTE-117/pdf/STATUTE-117-Pg2888.pdf.

[21] *Poison Control Center Enhancement and Awareness Act*, 2003, Government Printing Office, http://www.gpo.gov/fdsys/pkg/PLAW-108publ194/pdf/PLAW-108publ194.pdf.

[22] Henry A. Spiller, and Jill R. K. Griffith, "The Value and Evolving Role of the U.S. Poison Control Center System," *Public Health Reports* 124, no. 3 (2009): 361.

that is working in the capacity of a specialist in poison information and has completed 2000 hours of work in a poison center and has managed 2000 cases.[23] Once certified, the staff person must recertify every seven years by retaking this exam.

Medical toxicologists are medical doctors that often function in the capacity of medical directors and oncall consultants for the poison centers. Their work commitment may vary depending on the organizational structure from a halftime to fulltime position. Medical toxicologists attain board certification by the American College of Medical Toxicologist (ACMT) as well within their own medical specialty, such as emergency medicine, pediatrics, occupational medicine, or internal medicine. In addition, medical toxicology is now recognized as an accredited medical fellowship.[24]

Clinical toxicologists are doctors of pharmacy that attain board certification in clinical toxicology by the American Board of Applied Toxicology. They provide a variety of functions within a poison center, including managing director, clinical director, toxicology consultants, and CSPIs.

Public health educators working within a poison center have varied educational backgrounds. Some hold degrees in education, health care education, nursing, medicine, pharmacy, or public health. While there is no formal education required for this position, there are mentorship programs, opportunities for collaborations, and membership within the AAPCC Public Education Committee (PEC).[25]

3. Center Accreditation

Not only do staff members need to attain certification within their specialty, but poison centers must also be accredited by the AAPCC to be a recognized center within the AAPCC membership, receive state and federal support, and participate in AAPCC initiatives, such as toxicosurveillance. The accreditation process is a peer review process

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[23] "CSPI Exam Criteria for Specialists in Poison Information," American Association of Poison Control Centers, accessed November 5, 2015, https://aapcc.s3.amazonaws.com/pdfs/member-.

[24] Robert S. Hoffman et al., *Goldfrank's Toxicologic Emergencies*, 10th ed. (New York: McGraw Hill, 2015), 12.

[25] Institute of Medicine Committee, *Forging a Poison Prevention and Control System*, 212.

using a quantitative and qualitative approach to assess the level of performance of each center. An accreditation review committee made up on representatives from the membership, not including board members, reviews applications, and conducts face-to-face interviews with center staff as part of the accreditation process. Currently, all 55 poison centers are accredited. Each center must submit an application for accreditation every seven years and verify annually that in compliance with all of the accreditation regulations.[26]

One of the key components of accreditation is that everyone has access to the poison center. In order to ensure this access, all poison centers must have a toll free number that is promoted and marketed throughout their catchment area. Access to this number must include provision for callers that are hearing impaired as well those with language barriers requiring an interpreter or the ability to connect to a language line. Staff must also be able to triage the calls effectively to ensure that exposures calls are handled prior to information calls and that calls from 911 and EMS are prioritized as well.[27]

How a poison center is staffed also comes under AAPCC accreditation guidelines. These guidelines ensure that all centers have a medical director, CSPI staff, a managing director, and an education staff. The educational background, certification, and ongoing training of all clinical staff must be documented. Additionally, there also needs to be documentation around the public education efforts, which includes presentations, public service announcements (PSAs), delivery of poison prevention literature, and ongoing needs assessments and evaluations of initiatives. All efforts around professional education, such as clinical rotations, toxicology presentations, and contributions to scholarly journals, should be documented.[28]

Having the ability to track and report on calls is also a key component of accreditation as toxicosurveillance is an integral poison center function. Equally

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[26] "New Accreditation Criteria: November 2014," American Association of Poison Control Centers [AAPCC], February 27, 2014, accessed November 6, 2015, www.aapcc.org/members/?title=&post_date=&resource_types=27#search 1.

[27] Spiller, and Griffith, "The Value and Evolving Role of the U.S. Poison Control," 360.

[28] "New Accreditation Criteria: November 2014," AAPCC.

important is the ability to demonstrate that quality initiatives, including review of cases and patient satisfaction surveys, are conducted.[29] Compliance with all of these regulations ensures that each poison center is providing the same standard of care, that there is continuity of care across the poison center enterprise and that patient outcomes and trends are tracked on timely bases in order to validate research, and support accepted treatment modalities.

4. Access

Poison centers have a call center infrastructure that allows for multiple callers to call into the center at one time, they have access to language lines to manage calls from non-English speaking callers, TTDY lines in place for callers who are hearing impaired and can accommodate additional staff to work during call surges. Many poison centers are now set up to allow for staff to work remotely. This accommodation provides continuity of services if the physical call center is located in a disaster area.[30]

Poison centers have an established relationship with staff of departments of health, healthcare facilities, emergency medical personnel, and the media. These relationships help facilitate productive communication during crisis situations.[31]

5. Funding

Poison centers are funded from different sources at the local, state, and national levels. State funding, which accounts for approximately 80 percent of their income, is used primarily to offset staffing costs. Many centers are located within a host institution such as hospitals, or universities. Some centers are affiliated with their host hospital's department of pharmacy or emergency medicine. For those located within a university, they are often connected to the school of pharmacy. There are some centers that receive

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[29] Ibid.

[30] Valerie A. Yeager, "Emergency Response, Public Health and Poison Control: Logical Linkages for Successful Risk Communication and Improved Disaster and Mass Incident Response," *Homeland Security Affairs* 5, no. 3(September 2009): 3–4.

[31] Kathy Lehman-Huskamp, and Anthony J. Scalzo, "Acute Disaster Response: Lessons Learned from a Small-scale Event," *Journal of Clinical Toxicology* 1, no. 104 (2011): 4, DOI: 10.4172/2161-0495.1000104.

private funding through insurance companies, add-ons to cost of purchasing license plates, or telephone surcharges. Poison center funding is often challenged on both the state and federal levels, forcing centers to look for creative funding solutions.[32]

Most centers receive some federal dollars to support educational and or technology needs.[33] The Poison Enhancement Act of 2000, which allowed for federal funding and partnership with HRSA, has been an effective effort to stabilize many centers and ensure that public and professional education efforts are maintained. Of the 136 million dollars spent, only 13 percent is federal funded.[34] There have been several reauthorizations of this Act that have resulted in a reduction of funding[35]

6. Scope of Service

Poison centers provide a variety of functions from triaging a poisoned patient to providing poison prevention education and awareness in order to prevent poisoning from occurring. The following paragraphs provide a description of poison center services.

a. Phone Triage

Poison centers are most recognized for work around phone medical triage. Calls are received from the general public as well as from health care providers who are looking for both poison information and management recommendations. These calls come from a variety of sources including homes, schools, industries, and hospitals. The majority of the calls managed by poison center staff are from the home, and in most cases, the patients can be safely managed at home.[36] This service reduces the number of unnecessary hospital visits and reduces the stress on busy emergency department staff as

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[32] Spiller, and Griffith, "The Value and Evolving Role of the U.S. Poison Control," 362.

[33] Pourmand, Wang, and Mazer, "A Survey of Poison Control Centers Worldwide," 1.

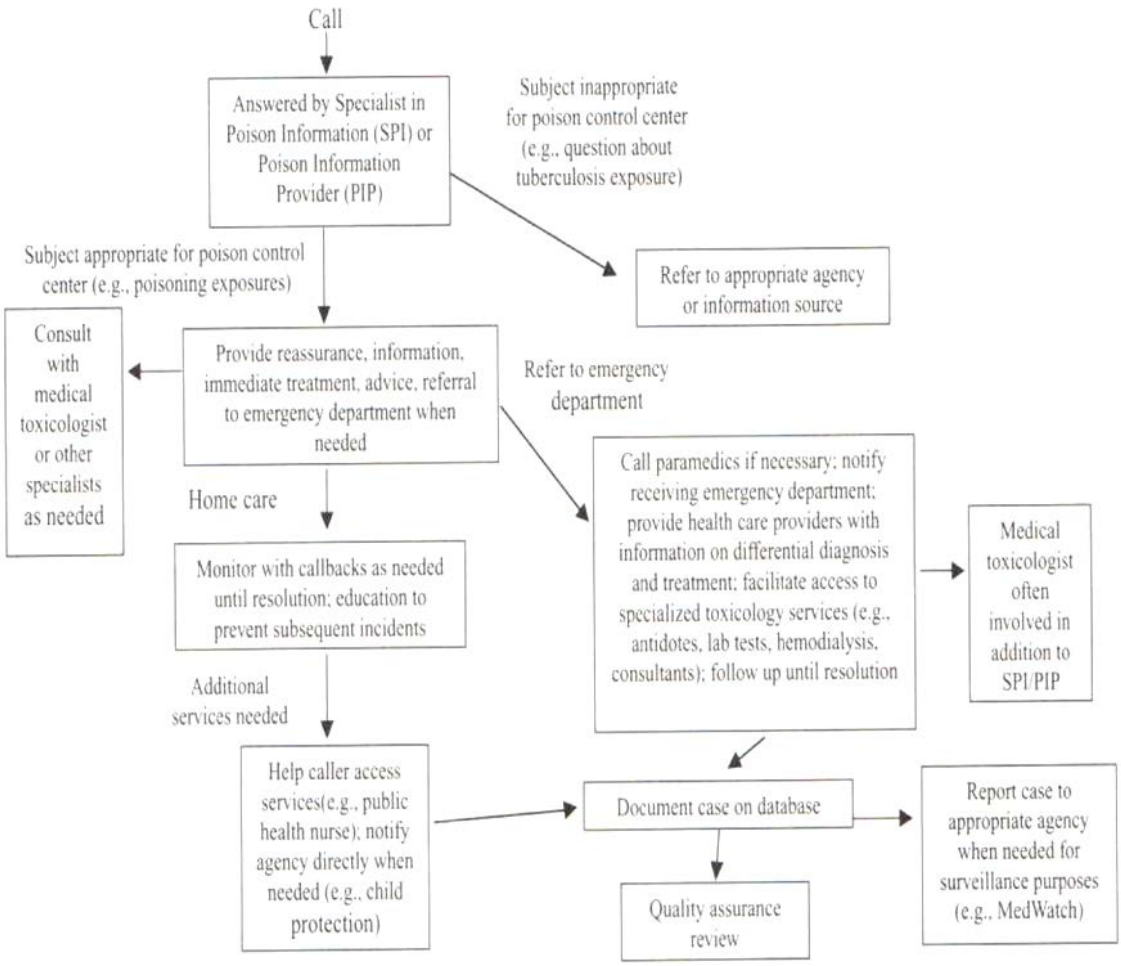
[34] National Conference of State Legislatures, "Poison Control Center Laws," 2011, accessed July 8, 2015, http://www.ncsl.org/research/health/poison-control-center-state-laws.aspx.

[35] American Association of Poison Control Centers, "Poison Center in Danger," accessed July 8, 2015, http://www.aapcc.org/about/poison-centers-danger/.

[36] Poison Center Task Force, "Poison Centers: An Information Paper," ACEP, September 2010, http://www.acep.org/Content.asp?id=70370&terms=poison%20center, 1–2.

well as the trauma to a patient associated with an emergency room visit. The algorithm in Figure 1 illustrates how calls are triaged by CSPIs.

Figure 1. Call Algorithm



Source: Institute of Medicine, *Forging a Poison Prevention and Control System*, 108.

b. Poison Education Awareness

Poison prevention education and awareness continues to be integral to poison control center initiatives. Spiller and Griffith maintain that prevention education reduces

emergency department visits and awareness education increases utilization[37] The Institute of Medicine (IOM) report also acknowledges that while tracking and managing poisonings are in the forefront of poison center, functions so is poison prevention education. The public education committee of the AAPCC was established to standardize some of the poison prevention education across all poison control centers and to provide a vehicle for vetting some of the "homegrown initiatives" utilized from state to state. There is also a federal supported initiative around prevention education through HRSA.[38]

c. Professional Education

Professional education activities include serving as a clinical rotation site for medical, nursing and pharmacy students, presenting at local, state, and national conferences, conducting ongoing research, and contributing to scholarly journals and textbooks.[39] One of the most important aspects of providing professional education to health care providers is to help them gain a better understanding of the scopes and service of a poison center and to demonstrate how a poison center can help them with their patient care.

d. Toxicosurveillance

The National Poison Data System (NPDS) is used nationwide to conduct real-time toxicosurveillance around biological, chemical, radiological threats. NPDS allows centers across the county, in conjunction with the Centers for Disease Control and Prevention, to employ an "all hazards" approach to identifying threats and provide a framework for poison centers to collect data on human and animal exposures related to poisonings.[40]

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[37] Spiller, and Griffith, "The Value and Evolving Role of the U.S. Poison Control," 61.

[38] Institute of Medicine, *Forging a Poison Prevention and Control System*, 131.

[39] Spiller, and Griffith, "The Value and Evolving Role of the U.S. Poison Control," 61.

[40] Center for Disease Control and Prevention, *Radiation Emergencies Public Health Roundtable: The Role of Poison Centers* (Atlanta, GA: Center for Disease Control and Prevention, 2012), http://emergency.cdc.gov/radiation/pdf/summary_report-_radiological_emergencies_public_health_roundtable_4-29-13.pdf, 8–9.

e. Disaster Planning

During a disaster, poison centers play a role in disseminating information to the general public through media releases, interviews, and website postings. Poison center staff also assess the degree of exposures, direct callers to the appropriate level of care if needed, and provide treatment advice to health care providers, particularly to those health care facilities in remote and rural areas that may not have experience, training, or expertise in managing this type of exposures.[41]

7. Situational Awareness

Poison centers provide situational awareness around drug abuse trends, effects of new products on the market and the misuse of drugs and chemicals. During 2011 Poison Center detected and tracked growing abuse around a new synthetic drug coined "bath salts." A study conducted at the Texas Poison Centers demonstrated the growing frequency in abuse cases with this drug from 2010 to 2011. This center was able to detect this trend and provide management guidelines to health care providers.[42]

8. Public Health Response

There have been several programs and initiatives that have resulted from collaborations with national partners and organizations, such as the CDC, HRSA, Consumer Protective Safety, and SafeKids. One initiative that has been very successful is the Preventing Overdoses and Treatment Exposure Task Force (PROTECT) initiative. In response to the growing number of children that are involved in unintentional exposures to medications, a group of public health partners convened to develop strategies and implement educational programs to address this issue.[43]

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41 Ibid.

42 Mathias B. Forrester, and Tracy Haywood, "Synthetic Cathinone Exposure Reported to Texas Poison Centers," *The American Journal of Drug and Alcohol Abuse* 38 (2012): 614.

43 Daniel S. Budnitz, and Salis, Spencer, "Preventing Medication Overdoses in Young Children: An Opportunity for Harm Reduction," *Pediatrics* 127, no. 6 (2011): 1598.

Another example of a collaborative public health response is poison center's involvement with the CDC's "Flu on Call." This program was developed in response to the growing concerning over a pandemic flu occurring in this country.[44] More details of this collaboration with program are provided in Chapter II.

While there are variations between each poison center in the delivery of these services, what does remain constant are those efforts around case management, intelligence gathering, disaster response, and prevention education. In the subsequent chapters, there is a more extensive discussion of each of these efforts with corresponding examples, case studies, and a critical look at the effectiveness of each service.

D. LITERATURE REVIEW

A literature review was conducted to examine the research and published materials on effectiveness of poison centers in areas such as disaster response, situitational awareness, communication, collaboration, reduction of health care costs, and clinical expertise. Also reviewed where those agencies who conduct biological and chemical surviellance. Key words and phrases used for this literature search included: biosurveillance, toxicosurveillance, poisonings, and poison control centers. Sources used for this search were obtained from Naval Postgraduate School's Dudley Knox Library and the Upstate Medical University Library.

This literature review is divided into the following areas: chemical and bio surveillance, federal response, surveillance methods, and poison centers surveillance. These categories were utilized in order to compare and contrast other surveillance initiatives with those of poison centers as well other poison center's functions around planning, response, and mitigation of threats to our communities.

[44] Association of State and Territorial Health Officials, "Flu on Call™: An Innovative Strategy to Provide Services to ILL People and Reduce Demand on Medical Facilities during a Severe Pandemic," accessed November 6, 2015, http://www.astho.org/Preparedness/Flu-on-Call/Flu-on-Call-issue-Brief//.

1. Chemical and Bio Surveillance—Federal Response

Homeland Security Presidential Directive (HSPD)-12 calls for data collection and analysis relative to human and an animal threats and illness occurring from infectious processes, toxic exposures as a result of a manmade or natural disaster.[45] The stated purpose of this data collection and analyses is to provide the general public, public health professionals, health care providers, and government officials with information early in the course of an occurrence to help minimize the impact and initiate the appropriate response.[46] *Homeland Security Directive 21* expands on this and includes a nationwide effort inclusive of state and local efforts.[47] The *National Strategy for Homeland Security*, the *National Strategy to Combat Weapons of Mass Destruction and Biodefense for the 21st Century* also calls for an integrated approach to preparing for a catastrophic health event.[48] This integrated approach calls for collaboration and involvement around preparedness among various governmental agencies, members of the community, representation from colleges and universities, health care providers, public health professionals, and families in their designated area.[49]

The CDC is a leading agency in biosurveillance. It has several programs that address infectious disease and biological threats in this country and across the globe. In their article, Christian et al. chronicle some of the activities of the CDC's Disease Detection Program. In addition, she and her colleagues review some of the most common disease threats in 2012 and 2013, including but not limited to MERS and influenza.[50]

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[45] Nicholas E. Kman, and Daniel J. Bachmann, "Biosurveillance: A Review and Update," *Advances in Prevention Medicine* 206, no. 8 (2012): 2. DOI: 10.1155/2012/301408.

[46] Ibid.

[47] Ibid.

[48] Ali S. Khan et al., "The Next Public Health Revolution: Public Health Information Fusion and Social Networks," *American Journal of Public Health* 100, no. 7 (2010): 1238, DOI: 10.2015/ AJPH.2009.180489.

[49] National Security Council, *National Strategy for Countering Biological Threats* (Washington, DC: National Security Council, 2009), http://www.whitehouse.gov/sites/default/files/National _Strategy_for_Countering_BioThreats.pdf.

[50] Kira A. Christian et al., "What We Are Watching: Five Top Global Infectious Disease Threats, 2012: A Perspective from the CDC's Global Disease Detection Operations Center," *Emerging Health Threats Journal* 6, no. 10 (2013): 3, 6.

One of the CDC's programs is called Biosense. It was started in 2003 as part of the CDC's Public Health Network to collect from Department of Defense (DOD) information from its outpatient clinics any case trends and suspicious or concerning patient presentations that are consistent with unusual and emerging infectious diseases. In 2005, Biosense was expanded to include non-DOD health care facilities as well. Tokars et al. were the first to conduct research and publish an analysis of the effectiveness of Biosense. They reviewed 2008 data and concluded from their findings that the program needed to be expanded; there needed to be an increased use of electronic monitoring and that data sharing and engagement needed to occur on a local level.[51]

The CDC has extended its reach beyond the traditional reporting sources, noted above, to include the Early Aberration Systems, which tracks EMS calls, drug store purchases, animal visits, and missed school days. Kman and Bachman look at each of these systems as well as those based on laboratory analysis, the resulting reporting, and environmental tracking such as the CDC's Biowatch. They suggest that despite funding and multiple efforts, the current system for tracking is deficient. These authors call for a more unified approach that tracks threats across the globe that ensures effective and accurate reporting utilizing innovative technology.[52]

The CDC is not the only government agency involved in surveillance, the Department of Defense (DOD) oversees the Global Emerging Infections Surveillance and Response system, which is housed under the Division of Armed Forces Health Surveillance Center (AFHSC). This project falls under the preview of the deputy secretary of defense. The goal of this program is to detect, respond, conduct research, build partnerships around diseases that result in respiratory, gastrointestinal, or fever

[51] Jerome Tokars et al., "Summary of Data Reported to CDC's National Automated Biosurveillance System, 2008," *BMC Public Health* 10, no. 30 (2010): 9–11, DOI: 10.1186/1472-6947-10-30.

[52] Kman, and Bachmann, "Biosurveillance: A Review and Update," 2.

systems and include sexually transmitted disease, airborne, or aerosolized agents and those diseases that are resistant to antibiotics.[53]

The Department of Homeland Security's fusion centers are also involved with surveillance activities. These fusion centers are geographical diverse, and with a multidisciplinary staff, they engage both public and private collaborators.[54] One of their initiatives was a pilot program called BioPHusion, which was launched by the CDC. The objectives of this pilot are to gather emerging information, determine threats, and act on these threats through sharing of information. Surveillance efforts were conducted using such tools as Global Public Health Information Network (GPHIN), ProMed, Google searches, and Argus. A review was conducted of the data collected and information exchanged from July of 2008 through July of 2009, conclusion drawn from this study is that innovation is needed, not around the development of new surveillance tools but rather on a social network construct that brings together federal, state, and local stakeholders that not only allows for but encourages the exchange of information.[55]

2. Surveillance Methods

There are numerous methodologies utilized with surveillance. Some focus on the point of entry into a health care facility, as described by Griffin et al. Griffin discusses the utility of gathering from emergency departments the number of patients and their presenting flu-like symptoms as a predictor of outbreaks.[56] Biosense utilizes both syndromic surveillance and case-based surveillance. The first term refers to presenting symptoms, and the latter refers to verifiable quantitative results.[57]

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[53] Kevin L. Russell et al., "The Global Emerging Infection Surveillance and Response System (GEIS): A U.S. Government Tool for Improved Global Biosurveillance: A Review of 2009," *BMC Public Health* 11, no. 52 (2011): 2, 10, DOI: 10.1186/1471-2458-11-S2-S2.

[54] Khan et al., "The Next Public Health Revolution," 1238.

[55] Ibid., 1240.

[56] Beth Ann Griffin et al., "Early Detection of Influenza Outbreaks Using the DC Department of Health's Syndromic Surveillance System," *BMC Public Health* 9, no. 483 (2009): 17, DOI: 10.1186/1471-2458-9-483.

[57] Tokars et al., "Summary of Data Reported," 9–11.

Nelson et al. presents a less restricted and more collaborative approach to collecting epidemic intelligence. In addition, Nelson describes the utility of using Internet sources such as Twitter, FaceBook, or Google searches or event-based surveillance. Event-based surveillance is utilizing Internet sources for the recognition and tracking of disease outbreaks. Nelson reviews common biosurveillance systems such as Project Argus, BioCaster, Global Public Health Intelligence (GPHIN), and HealthMap.[58] Each of these systems uses a different language, provides large amounts of data that has to be validated and distilled down to something manageable, and must perform in a timely manner.

Nelson et al. reported on their research project that looked to compare WHO and that collected by the Argus system for H1N1 reported cases from August 2009 to January 2010.[59] The areas they compared include: the number of reported cases, the number of deaths, shortage of hospital beds and resources, vaccine reactions or infective vaccines, and co-morbidities. Results suggest that unlike more traditional and official systems, Internet surveillance is open to the general public and the information is disseminated in real time.[60]

An example of how an Internet-based search has utility in responding to a public outbreak is with the incident dengue fever in Madeira in October of 2012. An Internet search during September of 2012 revealed several documented reports on an increase in the mosquito population; this was followed by several confirmed cases of dengue fever one month later. This intelligence was shared across Europe, with the Portuguese public health officials, and the general public. Quick sharing of this information allowed for a quick response, such as limiting travel and exchange of goods.[61]

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[58] Noele P. Nelson et al., "Event-Based Internet Biosurveillance: Relation to epidemiological Observation," *Emerging Themes in Epidemiology* 9, no. 1 (2012): 2. DOI: 10.1186/1742-7622-9-4.

[59] Ibid.

[60] Ibid., 3.

[61] David M. Hartley et al., "An Overview of Internet Biosurveillance," *Clinical Microbiology and Infection* 19, no. 11 (2013): 1010, DOI: 10.1111/1469-0691.12273.

3. Poison Centers Surveillance

The National Poison Data System (NPDS) collects data from all of the nations poison centers on human and animal exposures related to poisonings. Cases are uploaded to the CDC every eight minutes.[62] Once the data is uploaded, a national toxicosurveillance team from the AAPCC membership reviews the data and looks for outliers, trends, an increase in clinical effects, and an increase in call volumes.[63]

Simone and Spiller suggest that NPDS data is more reliable and timely than what is generated by other national surveillance systems and has great utility in its ability to upgrade its coding.[64] NPDS can be updated to reflect new coding needs by engaging the NPDS Rapid Response Coding Team. Simone and Spiller also noted that the accuracy of the data is better than some systems and comparable to others.[65]

The National Injury Prevention Surveillance System—Med Watch captured significantly fewer adverse drug events than NPDS.[66] The data collected from Toxic Exposure Surveillance System (TESS) and NPDS not only provides alerts regarding public health threats but also provides product safety information to industries and about their products.[67] NPDS data is disseminated more rapidly as compared to other data such as the CDC's Morbidity and Mortality Monthly (MMWR).The MMWR does not publish its findings until a trend is found, and the CDC's hospital's reported admission and death cases are published on an annual basis.[68]

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[62] Mowry et al., "AAPCC 2013 Annual Report," 1039.

[63] Amy F. Wolkin et al., "Using Poison Center Data for National Public Health Surveillance for Chemical and Poison Exposure and Associated Illness," *Annals of Emergency Medicine* 59, no. 1 (2012): 58–59, DOI: 10.1016/j.annemergmed.2011.08.004.

[64] Karen K. Simone, and Henry A. Spiller, "Poison Center Surveillance Data: The Good, the Bad and...the Flu," *Clinical Toxicology* 48, no. 5 (2010): 416.

[65] Elizabeth J. Scharman, "Liquid 'Laundry Pods': A Missed Global Toxicosurveillance Opportunity, *Clinical Toxicology* 50, no. 8 (2012): 725.

[66] Simone, and. Spiller, "Poison Center Surveillance Data," 416.

[67] Litovitz, "The Tess Database, Use in Product Safety Assessment," 19.

[68] Simone, and. Spiller, "Poison Center Surveillance Data," 416.

Scharman highlighted some of the drawbacks to the NPDS system. This system requires that specific product codes be entered in order to trigger an alert, suggesting an outlier has been detected. In May 2012, poison centers started receiving calls regarding exposures to liquid laundry pods. These cases were not entered into the NPDS database with a specific code because none existed at that point in time. Collegial information sharing regarding toxicity and outcome occurred via email between toxicologists from various poison control centers. Scharman suggests that NPDS alone is not sufficient and that sharing of information formally and informally across a variety of agencies is equally if not more reliable.[69]

E. RESEARCH DESIGN

Can poison centers improve outcomes during public health emergencies? Is so, how can they be better leveraged to meet homeland security needs? A descriptive case study analysis was conducted to determine if poison center utilization during public health emergencies improves outcomes. The analysis was centered on five of the core functions that poison centers nationwide provide. These core functions, as defined by the AAPCC, and include disaster response, providing situational awareness around emerging threats, communication of these threats to the general public and to health care responders, provision of clinical expertise and reducing the burden on health care facilities by preventing unnecessary emergency department visits, and reducing hospitalized patient's length of stay.[70]

The evaluated literature search case studies and research demonstrated both effectiveness of poison center utilization during emergencies and inherent limitations. Knowledge of poison center's function, scope of services, and clinical expertise are not widely known within the homeland security expertise. Cases studies and examples that demonstrate these capabilities were analyzed for this thesis.

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[69] Scharman, "Liquid 'Laundry Pods,'" 725.

[70] Poison Center Task Force, "Poison Centers: An Information Paper," 1–2.

Although individual poison centers vary somewhat in their capabilities, this analysis considered all poison centers in the country collectively. Poison centers not only have a shared mission, but each of the 55 recognized poison centers work collaboratively and are aligned through their membership within the AAPCC. The staff members from poison centers are elected to the board of the AAPCC where they serve on various organizational wide committees, represent the AAPCC on national level efforts, and drive organizational decisions. Center accreditation is approved by members appointed to the AAPCC Accreditation Committee. The criteria for accreditation are standardized across all centers. This criterion requires that poison centers be staffed similarly, contribute to the same surveillance database, provide comparable case management and engage in each of these core functions.[71]

The functions were analyzed as follows:

1. Disaster response: this function includes poison centers actions in the planning for and response to public health emergencies. The research assessed poison center's involvement is small- and large-scale disasters. The reviewed case studies included provision of clinical care, distribution of antidotes, and interaction with the general public through public service announcements and other types of messaging.

2. Situational awareness: this function is the tracking of trends that have the potential to threaten the well being of individuals and/or communities. These threats may be of a biological, chemical, or nuclear nature. They may be from natural or manmade causes. The threats are primarily detected when multiple cases are entered into the NPDS and the surveillance team detects an unusual occurrence or a high incidence of occurrence. A threat may also be detected when a center starts receiving numerous calls regarding a similar exposure or has multiple patients with unusual clinical presentations.

   This research looked at those incidences when a poison center's toxicosurveillance efforts provided detection of a threat that enabled an early warning to be initiated to health care and public health responders. Also considered were those occasions when efforts to inform the general public about an emerging threat was triggered by a poison center's surveillance efforts. Cases were reviewed that demonstrated how these surveillance efforts influenced response efforts and policy decisions.

[71] "New Accreditation Criteria: November 2014," AAPCC.

3. Communication: this function refers to how poison centers communicate information to the general public during an emergency, to health care and public health responders, to their colleagues at other centers, and within each of their centers. It includes interactions with the media, engagement of social media, and perception and utilization by the general public. This research focused on those conditions when the general public contacted a poison centers for information and guidance during a disaster, as well as how often. Also taken into consideration was the effectiveness in communication between poison center staff and health care providers as well as among poison center staff.
4. Reducing burden on health care: the research around this function pertained to documented evidence that poison centers reduce the number of unnecessary emergency department visits and hospital admission.
5. Clinical expertise: this function concerns clinical expertise that poison centers provide in the area of toxicologic emergencies. This research looked to determine if there was a link between medical outcome and consultation with a state poison center during a disaster. Case studies were examined poison center effectiveness, if and when poison center staff provided early identification and treatment recommendations during a threat.

Based on the analysis of the research, collected recommendations were formulated on how to more effectively levage these core functions. These recommendations have direct impact on health care providers with in health care facilities, emergency medical services, and county and state departments of health. They support local, state, and federal efforts including those around law enforcement, disasters planning, response, and mitigation. These recommendations include implementation strategies, a summary of benefits, and desired outcome measures that would help legislators and policy makers enact laws and support programs with a focus on emergency response.

There are some inherent limitations to analyzing this problem including the subjectivity of the researcher and limited objective cases studies on poison center efficacy in disaster response. The researcher is able to provide detailed information on the day to functioning of poison centers and has an appreciation of some of the nuisances of the organization based on over 20 years of experience working in a poison center and as a member of the AAPCC. The researcher has attempted a balanced evaluation by

examining not only the positive contributions that poison centers make during a disaster but also their inherent limitations. Finally, while there is limited research on poison centers effectiveness in disaster response, there is published studies on their effectiveness around these core functions.

F. CHAPTER OVERVIEW

Part of this research was to gain a greater understanding of the role poison centers play during normal operations and during a disaster. The following chapters examine the five core functions as they relate to homeland security. Chapter II provides cases studies illustrating poison center's response during several high profile disasters. Chapter III focuses on the situtional awareness component of a poison center's role in disaster response. Chapter IV focuses on internal and external communications capabilities and challenges. The clinical expertise of poison center staff, including CSPIs, toxicologists and educators, are presented in Chapter V. The focus of Chapter VI is how poison centers reduce the burden on health care facilities during a disaster as demonstrated health care cost savings attributed to poison center utilization. Included in each chapter are recommendations to better leverage these function. Finally, Chapter VII provides concluding remarks and observations**.**

II. DISASTER RESPONSE

A. OVERVIEW

A disaster is defined as an event that involves a large number of people, with patients displaying significant symptoms requiring medical attention to the extent that medical response is overwhelmed by the volume. Some researchers think that this definition should include small-scale events that do not involve a large number of people but still present a challenge to the medical responders due to unfamiliarity of the exposure.[72]

Regardless of the size of the disaster, poison centers play a role in disaster response. The educational background and toxicology experience of a poisons center's staff prepares them to triage quickly and assess the need for medical attention when exposed to a toxin. This ability to assess over the phone decreases the number of unnecessary emergency room visits during a disaster.[73] In addition, a poison center's staff has expertise and knowledge of various chemicals and their clinical effects. Information regarding these chemicals can be provided over the phone or can be faxed to those individuals onsite of a chemical spill. Ongoing provision of information to the general public is through media releases, interviews, and website postings.[74]

Over the last 100 years, there have been numerous documented disasters related to intentional and unintentional exposures to occupational chemicals, warfare agents, contaminated medications, food borne illnesses, and radiation. For example, World War I soldiers were exposed to chlorine phosgene and mustard gas; during the Vietnam War soldiers were exposed to Agent Orange.[75] Exposures to contaminated food have run the

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[72] Lehman-Huskamp, and Scalzo, "Acute Disaster Response: Lessons Learned," 2.

[73] Poison Center Task Force, "Poison Centers: An Information Paper," 2.

[74] Ibid., 3.

[75] Hoffman et al., *Goldfrank's Toxicologic Emergencies*, 17.

gamut from peanut butter contaminated with salmonella to coffee tainted with arsenic.[76] There have been incidences of product tampering, such as with the Tylenol and cyanide in the 1970s,[77] and cases of mass suicides with drugs. One example is with the Heaven's Gate cult. Thirty-nine members ended their life by ingesting a combination of alcohol and phenobarbital.[78]

Ivy et al. conducted a study looking at inclusion of deaf and hard of hearing inividuals in diaster prepardeness. Their study reveiled that poison centers are able to respond to that gap with the presences of TTY and language lines.[79] This is also an AAPCC requirement for center accrediation.[80]

Common to these and other disaster scenarios is the role poison centers have played in tracking these occurrences, providing early identification of the agent, informing and updating the public on update health concerns, and providing health care providers with treatment recommendations. The following paragraphs describe in detail some examples of incidences that occurred and the role poison centers played in disaster response.

B. TYPES OF DISASTERS

There are numerous types of disasters resulting from natural and manmade causes. A description of the different types of disasters and poison centers roles in responding to each type of disaster is provided in the following paragraphs.

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[76] Wolkin et al., "Using Poison Center Data for National Public Health Surveillance;" Amy F. Wolkin et al., "Early Detection of Illness Associated with Poisonings of Public Health Significance," Annals of Emergency Medicine 47, no. 2 (2006): 173, DOI: 10.1016/j.annemergmed.2005.09.016.

[77] Hoffman et al., *Goldfrank's Toxicologic Emergencies*, 20.

[78] Ibid., 23.

[79] Susan L. Ivey et al., "Assessment of State and Territorial Level Preparedness Capacity for Serving Deaf and Hard-of-Hearing Populations in Disasters," *Public Health Reports* 129 (2014): 148.

[80] "New Accreditation Criteria: November 2014," AAPCC.

1. Intentional Product Contamination

On April 27, 2003, staff of the Northern New England Poison Center began experiencing an influx of calls from callers experiencing "food poisoning like symptoms." The hourly rate of calls exceeded the average call rate and the similarity in symptoms, and the timeframe was such that the National Poison Data System (NPDS) early warning alert system was triggered. History obtained by the CSPIs working in the poison center revealed that each of these callers had attended a church picnic. It was further determined that the one common substance that they all had consumed was coffee. There were 16 people with symptoms and their symptoms were consistent with those of arsenic poisoning. This diagnosis was later confirmed when the perpetrator left a suicide note taking credit for the incident, which was the contamination of the coffee with arsenic.[81]

2. Intentional Biological and Chemical Exposures

Only days after the September 11, 2001 attacks on the World Trade Center, the citizens of the U.S. were faced with a growing concern around anthrax exposures. On October 4, the first case of inhalation anthrax was diagnosed and this led to several more cases, including one in New York City on October 12.[82] In total, there were 18 cases identified in Florida, New York City, the District of Columbia, New Jersey, and Connecticut. The outcomes ranged from full recovery to the death of five. The source of these exposures came in the form of a letter that contained the anthrax spores. These letters, when processed and subsequently opened, contained sufficient enough anthrax spores to produce symptoms.[83]

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[81] Wolkin et al., "Early Detection of Illness Associated with Poisonings," 173.

[82] Bradley A. Perkins, Tanja Poporic, and Kevin Yesky, "Public Health in the Time of Bioterrorism." *Emerging Infectious Diseases* 8, no. 10 (2002): 1015–1016.

[83] Philip S. Brachman, "Bioterrorism: An Update with a Focus on Anthrax," *American Journal of Epidemiology* 155, no. 11 (2002): 984–985.

Poison centers played a critical role during the anthrax scare. The Texas Poison Center alone managed over five hundred anthrax related calls.[84] In addition, its staff, like other poison center staff across the country, developed messaging on for the general public and health care professionals on transmission, symptoms, and treatment. The Texas Poison Center utilized its existing infrastructure and communication network to get the information to those in need. Furthermore, its partners included staff from local and state health departments as well as government, community, and health care leaders[85]

A poison center played a similar role when ricin was found in a postal facility in South Carolina on October 15, 2003. Through a team approach, which included the poison center for that area, close surveillance of patients presenting and admitted to health care facilities during that timeframe were screened to rule out an exposure.[86] The CDC reached out to the AAPCC and the NPDS team and directed them to review all of their incoming cases on an hourly basis to look for symptoms suggestive of ricin exposure. Nationwide surveillance and reporting was provided by the AAPCC and was shared with state and national partners including law enforcement.[87]

3. Unintentional Disasters—Naturally Occurring

Hurricane Sandy made landfall on October 29, 2012 hitting parts of the New Jersey shoreline causing immediate and post disasters threats. One threat came in the days following the hurricane as residents began using alternative sources for cooking and heat such as generators. When generators or outdoor grills are used inside where there is poor ventilation, the risk for carbon monoxide poisoning ensues, which is what occurred

84 Brandon Willis et al., "Analysis of Suspicious Powder Following the Post 9/11 Anthrax Scare," *Journal of Medical Toxicology* 4, no. 2 (2008): 93.

85 Institute of Medicine Committee, *Forging a Poison Prevention and Control System*, 133.

86 Joshua G. Schier et al., "Public Health Investigation after the Discovery of Ricin in a South Carolina Postal Facility," *American Journal of Public Health* 97, S1 (2007): S152.

87 Ibid., 154.

from October 29 and November 6. The New York City and New Jersey Poison Centers managed 263 calls regarding carbon monoxide poisonings.[88]

4. Unintentional Disasters—Nuclear Accident

When a disaster occurs anywhere in the world, Americans actively respond to the incident and provide on the ground support. This was such the case after the Fukushima Daiichi nuclear power plant was damaged in March of 2011. The earthquake and resulting tsunami that caused such widespread and significant damage to Japan also impacted those individuals who had responded to the incident. U.S. poison centers managed over 400 calls, 60 that were exposure related and the remaining were information calls. Not all calls were received by the same poison center, rather the national poison data tracking system provided the link that allowed for the dissemination of timely and accurate information to the public.[89]

5. Intentional Disasters—Occupational Related

In West Virginia, after the January 9, 2014 chemical spill from the Freedom Industries in Charleston, the surrounding community's water supply was contaminated and rendered unusable, affecting over 300,000 residents. The West Virginia poison center handled over 700 calls regarding this incident and managed to prevent numerous unnecessary emergency department visits by assessing and responding to callers through the poison hotline.[90]

A similar response was noted after the 2010 Gulf Oil Spill. Not only did the Louisiana Poison Center track and respond to calls, but it also actively engaged at the

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[88] Jacquelyn Clover, "Carbon Monoxide Exposures Reported to Poison Centers and Related to Hurricane Sandy-Northeastern United States," *Morbidity and Mortality Weekly Report* 61, no. 4 (2012): 905.

[89] Adam C. Pomerleau et al., "On the Role of Poison Centers in Radiation Emergency Preparedness and Response Activities: Findings of the 'Radiation Emergencies Public Health Roundtable' (Atlanta, GA—August 2012)," *Journal of Medical Toxicology* 10, no. 1 (2014): 107, DOI: 10.1007/s13181-013-0363-2.

[90] Jlaql Lan et al., "Toxicity Assessment of 4-Methyl-1cyclohexanemethanol and Its Metabolites in Response to a Recent Chemical Spill in West Virginia, USA," *Environmental Science & Technology* 49, no. 10 (2015): 6284.

local, state, and federal levels in developing guidance around health issues and concerns resulting from the spill. The poison center worked with the CDC and the Environmental Protection Agency (EPA) in providing a presence and response to the community and to state and federal officials. To date, this is considered one of the best examples of poison center integration in a national level response.[91]

A small-scale occupational emergency occurred in St. Louis, Missouri on August 2008 involving nine people exposed to the chemical p-nitroaniline. These patients arrived at different emergency departments with symptoms of green skin discoloration and difficulty breathing. Upon seeing patients with skin discoloration, emergency department staff assumed that the patients had a dermal exposure to this chemical and were at risk of exposing staff and other patients who may have come in contact with them. They initiated both decontamination efforts and isolation protocols for all patients and staff that had been in the waiting room and within the department.[92]

The poison center in St Louis was contacted by emergency department staff for treatment recommendations. Hazmat was also contacted. The management recommendations provided by the poison center were not followed, and the directions provided by hazmat were not communicated to the emergency responders. There were no calls to either the poison center or hazmat made by the responders at the scene.[93]

This failure to communicate and implement recommendations led to an incorrect assessment of the patient's situation and the potential for cross contamination with staff and other patients. The greenish discoloration of the patients' skin was due to the chemical causing the skin to turn yellow and the chemical reaction in the blood that caused a blue discoloration to the skin, which resulted in green skin. These patients were not a risk for spreading the chemical to other people. Based on this uninformed assumption, patients underwent unnecessary decontamination measures, and patients

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91 "Gulf Coast Oil Spill Update," *Update Poison Control Program*, October 2013, http://poisonhelp.hrsa.gov/uploads/fall2010.pdf.

92 Lehman-Huskamp, and Scalzo, "Acute Disaster Response: Lessons Learned," 2–3.

93 Ibid.

waiting in the emergency departments for unrelated issues where delayed in receiving care and had to be isolated due to exposure to these patients.[94]

6. Pandemic Flu and Ebola

The potential for widespread flu reaching pandemic proportions has been a growing public health concern, particularly around the so called "bird flu" or H5N1 or H7N9.[95] In response to this public health threat, the CDC is leading an effort to provide free phone triage to the general public in the event that flu pandemic occurs. It reached out to the following agencices to partner with them on this effort: the United Way 2–1-1, the AAPCC, the U.S. Department of Veteran Affairs, U.S. Department of Health and Human Services Resources and Service Administration, the National Association of County and City Health Officials, Public Health Management Corporation, the Council of State and Territorial Health Officials, and the Council of State and Territorial Health Officials. The CDC's initatiative is called Flu on Call,™[96]

The intent of this initative was to implement the Flu on Call line in the in the event of a pandemic flu to respond to a public need and redue the strain on health care faclities from an influx of patients. A toll free number would be activated that would be anserwered by one of the nations 2–1-1 centers and their staff would would direct the caller, based on their needs and questions, to either their own physician or to one several particpating poison centers.[97]

The plan had been to have a trained poison center CSPI available to provide guidance as well as facilite the caller's obtaining antiviral medication if indicated. This process was intended to not only minimize impact on doctor's office and hospitals but helps to contain the spread of this infectious disease by allowing callers to be treated at

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94 Ibid., 2–4.

95 "CDC Resources for Pandemic Flu," Center for Disease Control and Prevention, last modified October 20, 2015, www.cdc.gov/flu/pandemic-resources/.

96 Association of State and Territorial Health Officials, "Flu on Call."

97 Ibid.

home.[98] At this point, poison centers would not be particpating in this initative, but the CDC along with its partners would continue to refine and work toward implementing this resource for the community.

Poison Centers are well positioned to particpate in this type of initative as they have the phone lines in place, staff who are accustomed to responding to sick patients, and they have the ability to staff up based on a call surge. Furthermore, poison centers and the 211 particpated in two practice drills that tested their capabilties and demonstrated success in handling call surges.

There are other similar poison center iniatives that support this model as well, including flu help lines that many centers established during the H1N1 pandemic flu in 2009 to 2010. The Minnesota Center received over 27,000 flu related calls and managed to prevent 11,000 people from seeking unnecessary emergency department care.[99]

During heightened concerns around Ebola cases in this country, several poison centers posted information sheets on their websites, including updates on the number of cases, symptoms, how the disease is spread and links to the CDC website. Some centers, such as the Illinois Poison Center and the North Carolina Poison Center, received their states' designation as the Ebola hotline.[100]

7. Planning and Drills

Poison center staff members have participated on local and state disaster planning committees prior to September 11, 2001. Additionally, staff participate in local- and state-run disaster drills. Most recently, they have participated in the CDC's Radiation Emergencies Public Health Round Table: The Role of Poison Centers. This roundtable was hosted by the CDC in Atlanta Georgia and brought together 36 staff members from

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98 Metro Omaha Medical Society, "On Call and Ready: Should an Influenza Pandemic Strike," *Physicians Bulletin* (November–December 2014) :22.

99 Ibid.

100 Illinois Poison Center, "State's Ebola Hotline Activated at Illinois Poison Center," assessed January 19, 2015, http://illinoispoisoncenter.org/states_Ebola_Hotline_Activated_at_ Illinois_Poison_Center.

poison center's across the country and high-ranking department of health staff from Georgia and Alabama for an intensive two-day program to discuss radiological and nuclear disasters.[101]

During a disaster, poison centers would play a role in disseminating information to the general public through media releases, interviews, and website postings. Poison center staff would also assess the degree of exposures, direct callers to the appropriate level of care if needed, and provide treatment advice to health care providers, particularly to those health care facilities in remote and rural areas who may not have experience, training or expertise in managing this type of exposure.[102]

8. Antidotes

Poison centers also track available antidotes throughout a region. For example, they know which hospitals have snake antivenin. Poison centers staff have knowledge of the levels of care provided by the hospitals in their area and can direct a patient to the most appropriate facility.[103]

The model of the Pittsburgh Poison Center is that it distributes the needed medications during a chemical or biological incident before the national stock is made available. This model allows for a quick response time and directly impacts patient outcomes. Other poison centers nationwide have adopted this model as well.[104]

C. ANALYSIS AND RECOMMENDATIONS

The scenarios described in the previous sections demonstrate that poison center's disaster response efforts are clearly linked to situational awareness, communication infrastructure, and staff's clinical expertise. These centers are poised and ready to respond to a disaster. The ability to ramp up staffing with clinical experts who are able to

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[101] Center for Disease Control and Prevention, *Radiation Emergencies*, 5.

[102] Ibid., 8–9.

[103] Barbara Crouch, "Role of Poison Control Centers in Disaster Response Planning," *American Journal of Health-System Pharmicist* 59, no. 12 (2002): 1161.

[104] Katie Traynor,"Pittsburgh Poison Center is Terrorism Response Leader," *American Journal of Health Systems Pharmacists* 61, no. 21 (2004): 2240, 2243.

address chemical, biological, and nuclear threats is an asset to this country's well being. Poison centers have the capabilities to provide a high level of clinical expertise while at the same time be cognizant of the need to conserve resources. This is done without compromise to quality patient care.

One way that poison centers are able to respond to in an influx of calls during a disaster is through their remote staffing capabilities. Trained CSPIs have virtual poison centers at home that are linked to their poison centers. Calls come into their home offices and into the poison center at the same time. They are able to respond to callers, have the same access to resources, and can document the cases into the shared patient database. Remote staffing not only extends staffing possibilities, but in some cases, minimizes the need for staff to come in their centers to work. This would be most beneficial during a pandemic flu, when a physical center has been impacted by an event or when traveling is dangerous as in an ice storm or blizzard.

Some of the benefits are anecdotal as there is limited published data around the role poison centers play during a disaster. Darracq et al. took on the task of reviewing the literature, surveying the managing directors from the poison centers nationwide on what role they have played during a disaster, collecting and analyzing the responses, and then publishing their findings. Additionally, they collected survey responses from the managing directors of 57 poison centers that were operational during the months from December 2011 to February 2012. The survey was designed to gather information regarding the role the centers played disaster planning and public health response.[105]

The results of this study indicated that all of the 57 poison centers surveyed had a disaster plan in place. This is a marked improvement from the 1996 study where only half of the poison centers in the country had a disaster plan in place. Of equal interest in the results from this current study was that the managing directors from half of the centers stated they participated in disaster drills. Furthermore, 90 percent of them also described

[105] Michael A. Darracq et al., "Disaster Preparedness of Poison Control Centers in the USA: A 15-Year Follow-up Study," *Journal of Medical Toxicology* 10, no. 1 (2014): 21, DOI: 10.1007/s13181-013-0315-x.

a level of comfort in dealing disaster related issues but less than half indicated any involvement in post-disaster initiatives.[106]

One way to address the improvement of participation in disaster drills is through ongoing efforts at the local, state, and federal levels in both participating and planning in small- and large-scale disaster exercises. This ongoing participation would increase a managing director's opportunities to be involved in post-disaster initiatives as well—a deficiency that was also addressed in this study.

Feedback provided by the participants in the CDC Radiation Roundtable Exercise was that more joint exercises and trainings were needed to increase their level of comfort in dealing with radiological disasters.[107] Building on the success of this roundtable, the CDC should host annual exercises that include poison center staff. Staff should participate in FEMA trainings as well.

The small-scale disasters presented in this chapter illustrate some areas where there needs to be a more collaborative approach to managing disasters. Lehman-Huskamp and Scalzo suggest that if the directions provided by hazmat had been communicated to the staff at the hospital, dealing with the p-nitroaniline exposure in St Louis, and if the emergency department staff that had reached out to their poison center and followed their direction, time and resources would not have been wasted and other patients would not have been inconvenienced. These authors further suggest that a poison center should be made aware of all hazmat notified events so that it could help distribute timely and effective recommendations to responding hospitals.[108] A greater effort towards systematic integration of poison centers with other responding agencies, such as should be made.

The Saint Louis case study, presented in Section B 5, Intentional Occupational Exposures, demonstrates how poison centers are not often involved in the initial response efforts after a mass poisoning. This is especially concerning when the disaster involves

106 Ibid.

107 Center for Disease Control and Prevention, *Radiation Emergencies*, 5.

108 Lehman-Huskamp, and Scalzo, "Acute Disaster Response: Lessons Learned," 5.

chemical, biological, or radiological exposures. The initial contact with a poison center for a mass poisoning is often from an emergency department after it starts seeing patients. The implications of this delay are that emergency departments start to become inundated with patients, some of whom may not need emergency care. Involving the poison center not only reduces panic and contains the spread of a chemical or biological exposure but also conserves resources.

The conservation of resources is key when dealing with a large-scale incident. These resources may include antidote, which poison centers track routinely, and can help with mobilization for one area of the country to another. Equally concerning is that hospital staff and emergency medical service (EMS) may be unfamiliar with the exposure agent. A lack of knowledge of anticipated symptoms, necessary self-protective precautions, and standard of care will all delay treatment and potentially put the health care providers at risk. Poison center staff have access to resources, the expertise and knowledge to develop management recommendations, the ability to provide guidance on precautions, and they are able to disseminate this information quickly and across a large catchment area.

Effective disaster response occurs at all levels. Building strong working relationship and fostering communication is critical during these times. A neutral agency, such as a poison center, is able to be that conduit for effective and unfiltered communication during a crisis. The case studies, presented in Chapter II, Section 2, Intentional Biological and Chemical Exposures, regarding the anthrax and ricin scares, demonstrate the level of effective communication and the poison center's role on a national level for providing timely and critical information to the general public regarding a threat.

The case study regarding the coffee tainted with arsenic is an excellent example of the importance of strong collaborations on local, state, and federal levels. Having the knowledge and relationship with a poison center allows one to "tap in" those resources quickly and with confidence. In turn, a poison centers are able to reach out to their partners and engage them as needed.

Implementation of these recommendations should include developing a more collaborative relationship with agencies within the Department of Homeland Security, specifically with FEMA, as there would be enhanced opportunities to participate in disaster planning, response, and mitigation. Inclusion of poison centers in the planning of disasters would minimize the likelihood of delayed notifications to a potion center after an event because they would be included in the response plan on a state and federal levels.

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III. SITUATIONAL AWARENESS

A. TOXICOSURVIELLANCE

NPDS provides a framework for poison centers to collect data on human and animal exposures related to poisonings.[109] This highly functional syndromic-based program is utilized by all AAPCC certified poison centers. Exposure cases called in to a poison center are entered into a data collection program at the local site and are then uploaded to the NPDS every eight seconds.[110] A national toxicosurveillance team compromised of highly trained toxicologists from the American Association of Poison Control Center's membership reviews the data on a daily basis looking for outliers, trends, increase in clinical effects, and call volumes. If a large number of cases or an unusual toxin is detected from a poison center, it is contacted to confirm and validate that the data is correct.[111] This rapid assessment allows for the generation of alerts in real time to other poison centers throughout the nation, as well as to health care facilities, departments of health, law enforcement, and the general public. Additionally, the data collected by NPDS not only provides threat assessment, but it is also useful for tracking adverse events around pharmaceutical agents, to provide data in support of public health initiatives, as a component of research studies, and for the compilation of an annual morbidity and mortality case reports.[112]

1. Technology

NPDS is compatible with four computerized case management systems: DotLab,toxiCALL,ToxSentry, and CasePro.[113] Each of these systems utilize predetermined definitions developed by the AAPCC, each prompts for the same patient information, and each interfaces with a commercially developed product information

109 Wolkin et al., "Using Poison Center Data," 56.

110 "National Poison Data System," American Association of Poison Control Centers.

111 Ibid.

112 Ibid.

113 *NPDS Coding Users' Manual,* American Association of Poison Control Center, 5.

database that provides product specific codes. In addition, each has a compatible interface to allow upload of cases to the AAPCC's national database. The product database Poisindex not only provides product codes but also product-specific information and management guidelines. Furthermore, it is supported by evidenced based toxicological research that is utilized by poison center staff.[114]

The AAPCC maintains a list of 1000 generic codes, some of which are linked to brand specific codes within Poisindex. There are also those occasions when the AAPCC sends a unique code associated with a specific occurrence or specific toxin. For example, during the Gulf Oil Spill in 2010, poison centers received and coded over 1000 exposure related calls. A unique code was assigned for these calls and this code was disseminated to all poison centers. Initially, this code was used for dermal and lung exposures, but then it was applied to cases where someone ingested oil-contaminated seafood as well.[115]

An example of one of the data collection programs is Toxicall, developed by the technology consulting firm Computer Automation Systems. Toxicall is used by the majority of the 55 poison centers across the country. Trained poison center staff enter patient/case information into the Toxicall database. There are several pre-determined data fields that are required for inclusion in NPDS reporting, and some fields that are utilized for patient care management at the individual poison center. NPDS required fields include species, age, sex, weight, zip codes, clinical symptoms, results from diagnostic testing, exposures information including substance, site of exposure, as well a medical outcome. Staff access drop down boxes that have a list of 131 symptoms and 72 treatments.[116]

NPDS surveillance is based on call volumes, clinical effects, medical outcomes and unique cases. Variances in call volume are noted when a center uploads a larger than anticipated number of cases. Each poison center has a pre-determined, baseline hourly

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114 *NPDS Coding Users' Manual*, American Association of Poison Control Center, 5; "Gulf Coast Oil Spill Update," *Update Poison Control Program*.

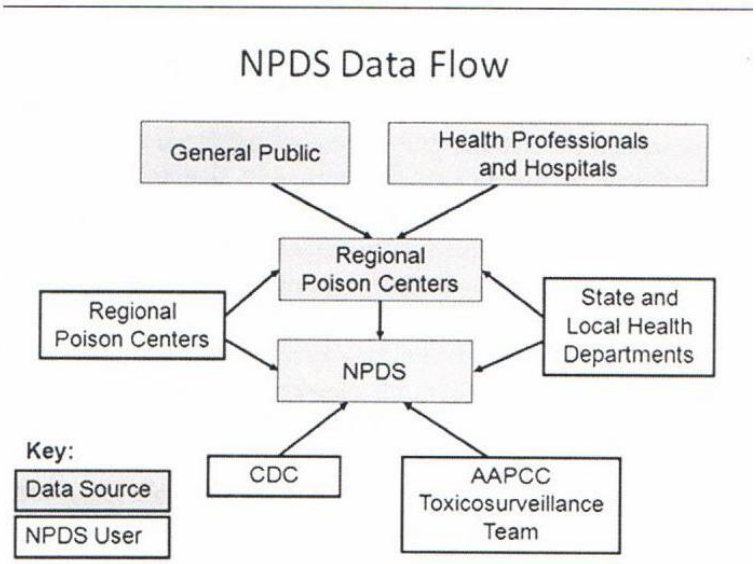
115 "Gulf Coast Oil Spill Update," *Update Poison Control Program*.

116 Wolkin et al., "Using Poison Center Data," 57.

call volume, and it is adjusted for normal variations. Call volume changes based on a specific zip code or county are also tracked along with surveillance around clinical symptoms.[117]

Symptoms that are not often seen, such as those from an anthrax exposure, will result in a triggering event. The final surveillance indicator is case based. There are 11 determinants used to track those cases that are of a highly suspicious nature. If a single or multiple cases meets the definition, an alert is sent to the originating poison center for case confirmation. These 11 triggers include acute radiation syndrome, arsenic, botulism, ciguatera, cyanide, nerve agents, paralytic shellfish, puffer fish, radiation injury, ricin, and smallpox.[118] The process for determining if there is a significant public health threat using NPDS data is illustrated in Figure 2.

Figure 2. Surveillance Algorithm[119]



Source: Amy F. Wolkin et al., "Using Poison Center Data for National Public Health Surveillance," 60.

[117] Ibid., 57–58.

[118] Ibid., 59.

[119] Ibid.

In addition to providing real-time surveillance, NPDS data is utilized to generate weekly, monthly, and annual reports. These reports can be run by individual poison centers to include their center specific information or to be inclusive of national data. State departments of health have free access to this data and can run reports as needed. County departments of health are provided county specific information upon request. Data on drug abuse trends are shared regularly with agencies such as DEA, as well as local, state and federal policy makers.

NPDS provides timely tracking of poison exposures and has the capacity to track anomalies nationwide, including the early detection of CBRN threats. The collaborative efforts around toxicosurveillance between the American Association of Poison Control Centers and the CDC provides the ability to share critical information to multiple partners, including public health, law enforcement, policy makers, and governmental agencies.[120]

2. Drug Abuse Trends

Poison centers are continually tracking new and emerging drug of abuse trends. This was the case when synthetic marijuana abuse increased substantially in 2010. This drug, widely abused prior to 2010 in Europe, was originally synthesized in a laboratory for legitimate medicinal purposes and not for the illicit purposes it is being used for now.[121]

The magnitude of this trend is evidenced by the NPDS data, which shows that in 2010 there were over 2500 calls to poison centers regarding synthetic marijuana cases and in 2011 there were just shy of 7,000 reported cases.[122] During 2013 and 2014, there appeared to be a drop in call volumes; however, as of April 2015, it was noted that the

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120 Ibid., 60.

121 Mathias B. Forrester et al., "Synthetic Cannabinoid and Marijuana Exposures Reported to Poison Centers," *Human and Experimental Toxicology* 31, no. 10 (2012): 1006, DOI: 10.1177/0960327111421945.

122 Office of National Drug Control Policy Executive Office of the President, *Synthetic Drugs* [fact sheet], February 2012, https://www.whitehouse.gov/sites/default/files/ondcp/Fact_Sheets/synthetic_drugs_fact_sheet_12-6-12.pdf.

number of abuse cases were significant enough to suggest that abuse of this drug is on the rise again. The AAPCC reported in April a 330 percent increase in call volume related to this drug since January 1. Equally impressive was a review of the data from 2014, which showed a 229 percent increase as compared to the same timeframe in 2014.[123]

Poison center staff not only detected and reported on this trend, but their clinical expertise was solicited by health care providers (HCP) caring for these patients. One explanation for the increase in health care facilities calls around these cases was that HCP had little knowledge of the toxicity of this drug and the presenting symptoms were unusual and not consistent with what they had previous seen with non-synthetic marijuana cases.[124]

Synthetic marijuana is not the only trend that has been tracked by poison centers. During the mid-2000s, there was a growing trend among teens to abuse over the counter medication (OTC) including the drug dextromethorphan (DMX). Poison center data has included this drug since the early eighties. During the late nineties to the mid-2000, several states reported an increase in abuse cases with DMX. The NPDS data reflects both generic and brand name of products. One of the most commonly abused brand that contains DMX is Coricidin[r]. In 2006, NPDS showed a decrease in Coricidin abuse but an increase in other products containing DMX. This information is useful as it helps determine prevention messaging.[125]

Anecdotal evidence suggests that use of heroin and other opioids continues to escalate in urban, rural, and suburban areas. Legislators and public health officials are pursuing and implementing strategies to help combat this crisis but face a major obstacle in the lack of shared intelligence and trend analysis. Town hall meetings are occurring

[123] Royal K. Law et al., "Increase in Reported Adverse Health Effects Related to Synthetic Cannabinoid Use," *MMWR* 64, no. 22 (2015): 618

[124] Forrester et al., "Synthetic Cannabinoid and Marijuana Exposures," 1009.

[125] Mathew D. Wilson et al., "Monitoring Trends in Dextromethorphan Abuse Using the National Poison Data System: 2000–2010" *Clinical Toxicology* 49, no. 5 (2011): 409, 414.

across the country with key stakeholders highlighting the impact of drugs abuse trends on their communities.[126]

3. Consumer Products

New products come on the market on a daily basis. Some of these new products can have dangerous consequences if used inappropriately. This occurred in 2011 when several companies introduced a new formulation for laundry detergents in the form of a "pod." This product has been known to cause children who accidentally ingested them to become gravely ill. The dangers of this new product were first reported by a poison center. The staff of the California Poison Center also began noticing a problem with these products when in March of 2012, a flurry of calls was received by its center regarding these laundry pods. The frequency of these exposures and the serious clinical effects resulting from these exposures prompted the development of a generic code to be used by all poison centers when they entered cases for NPDS.[127]

To this day, there are ongoing efforts to collect this data. These efforts include capturing specific brand names in order to facilitate research evaluating why some brands produce more symptoms then others. Also under research is why some children develop only mild symptoms as compared to others who develop life-threatening symptoms.[128] The positive outcome of detecting this issue and reporting on it is that some of the companies have added warning labels to their products and altered the packaging to discourage accidental exposure.[129]

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[126] Charles Schumer, "Schumer Calls for First Statewide Heroin Database: Lack of Information Hinders NY Law Enforcement's Ability to Combat Heroin Crisis; Drugstat Will Allow Local Cops, Hospitals and Toxicologists to Track Crimes and Overdose Patterns," March 5, 2014, http://www.schumer.senate.gov/newsroom/press-releases/schumer-calls-for-first-statewide-heroin-database-lack-of-information-hinders-ny-law-enforcements-ability-to-combat-heroin-crisis-drugstat-will-allow-local-cops-hospitals-toxicologists-to-track-crimes-overdose-patterns.

[127] S. J. Huntington, R. Vohira, Heppner, R. Mallios, and Robert. J. Geller, "Serious Adverse Effects from Single Use Detergent Sacs; Report from a U.S. Statewide Poison Control System," *Clinical Toxicology* 52, no. 3 (2014): 220.

[128] Ibid., 224.

[129] Ibid.

Other products that have been noted to cause unanticipated toxic effects include electronic nicotine delivery devices or e-cigs as they are commonly known. These devices, often sweetly flavored, capture the attention of small children, and they have contributed to nicotine related toxicity. From 2007 to 2014, there were over 2400 calls to poison centers around this product.[130]

As new products continue to enter the marketplace, poison center staff will continue to stay vigilant. Keeping track of unanticipated clinical effects and increases in call volumes around new products allows for the development of prompt warning, prevention messaging, and possible removal of the product from the market place.

B. ANALYSIS AND RECOMMENDATIONS

The need for biological and chemical surveillance that is accurate, time-sensitive, and allows for an actionable response to documented in the literature. The numerous and varied methodologies and agencies conducting this type of surveillance validates this and provides foundational cause for additional research and the refinement of processes. The research also provides supporting evidence of poison center's role in surveillance. This role should be expanded beyond drugs of abuse, carbon monoxide, and other chemicals, and biological threats such as influenza and Ebola.

To date, there is limited published research and cases studies demonstrating the efficacy of poison centers' response to these threats. Prevailing documentation shows that poison control centers have the ability to respond to threats in real time and that they have collaborative relationships with federal, state, and local public health, law enforcement, and health care agencies.

A CDC *Morbidity and Mortality Weekly Report* published on April 21, 2005 is a retrospective review of the data collected by Florida Poison Information Center Network during hurricane season from 2003 to 2005. This study reviewed cases of carbon monoxide, snake and bee bites, kerosene, propane, explosives, and food poisonings called

130 Kevin Chatham-Stevens et al., "Notes from the Field: Calls to Poison Centers for Exposures to Electronic Cigarettes—United States, September 2010—February 2014," *Morbidity and Mortality Weekly Report* 63, no. 13 (2014): 292.

into the Florida Poison Information Network in 2004 and 2005 post-hurricane landfall. This data was compared to control year 2003 when no hurricane occurred. Further discussed in this article was the daily reporting by the Florida Poison Information Center Network (FPICN) to its state departments of health as well as data sharing for the CDC on the Epidemic Exchange Network (EPIX). The information provided on EPIX reached health care provides, public health officials, and stakeholders, including policy makers across the state of Florida and across the nation. Public health warning, initiatives, and actions resulted from the information provided.[131]

While the NPDS is fairly robust and intuitive from a technological perspective, there are some significant limitations within the data collection process. These include a lack of a mandate requiring health care facilities to contact a poison center on all of their poison cases; staff subjectivity when entering case information; the need to rapidly create or update generic codes when a threat or call surge is noted; and limited or incomplete patient information from heath care providers, including history, presenting symptoms, and treatments provided.

Operator and provider subjectivity are directly linked to the quality of the data collected and reported. One solution to operator subjectivity is an increase in training on a national and local poison center levels. One such training effort is the "Tricky Coding Question," which is a weekly complex scenario sent to all poison center staff looking for their input on how they would code if the example provided was a real case. Feedback is than provided as to how the case should be coded based on the predetermined and agreed upon definitions established by the AAPCC.[132]

Two studies were conducted to look at the effectiveness of poison center staff coding: *Coding of Influenza H1N1 Virus Calls Received* by Forrester and Jaramillo and *A Controlled Evaluation of Case Clinical Effect Coding by Poison Center Specialists for*

131 "Monitoring Poison Control Center Data to Detect Health Hazards During Hurricane Season-Florida, 2003–2005," *Morbidity and Mortality Weekly Report* 55, no 15 (2006): 426–428.

132 "Therapy Options," in *AAPCC Members Resource,* September 19, 2012, accessed November 19, 2015, American Association of Poison Control Centers, https://aapcc.s3.amazonaws.com/pdfs/member-resources/Coding_Workbook_-_Therapy_Options.pdf.

Detection of WMD Scenarios by Beuhler, Whittler, Ford and Dulaney.[133] The first study looked at cases called into the Texas Poison Center Network from April 20 to September 30, 2009 regarding H1N1. These cases were reviewed to determine if they were coded correctly. Results of the study revealed only a 75 percent accuracy rate and also noted that as call volumes decreased accuracy increased.[134]

The second study detailed a case-based drill conducted at a single poison center. The staff was given case scenarios to code that were related to cyanide and botulism poisoning. Accuracy of coding in this study was determined to be dependent on the staff's level of experience with the agents, and if they held a certification in the toxicology field.[135] This study did not account for the variations in staff training from center to center.

A contributing factor to CSPI coding challenges is the tendency for health care providers to provide a limited or incomplete case history and presentation to them. If the information documented is limited by the information presented by the healthcare provider, appropriate response steps cannot be initiated. Factors influencing what is shared include time, perceived relevance, and what information the patient has provided. This lack of a complete picture limits what can be documented and produces a cascading effect. This effect is a delay in notification to hospital staff and EMS of the threat. In turn, this does not allow them to become familiar with the toxin before patients begin to arrive. They may have a lack of knowledge of anticipated symptoms, necessary self-protective precautions, and standard of care. Ultimately, this will impact the patients as treatment is delayed and potentially put the health care providers at risk.

Other factors contributing to the limited impact poison center surveillance has on depicting an accurate assessment of trends is with drug abuse trends. This is evident by

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[133] Mathias B. Forrester, and Jeanie E. Jaramillo, "Coding of Influenza A H1N1 Virus Calls Received by Texas Poison Centers," *Clinical Toxicology* 48, no. 6 (2010): 360, 362; Michael C. Beuhler et al., "A Controlled Evaluation of Case Clinical Effect Coding by Poison Center Specialists for Detection of WMD Scenarios," *Clinical Toxicology* 49, no. 7 (2011): 689

[134] Forrester, and Jaramillo, "Coding of Influenza A H1N1 Virus," 360, 362.

[135] Beuhler et al., "A Controlled Evaluation of Case Clinical Effect Coding," 689.

the underreporting of patients being treated in heath care facilities (HCFs) for opioid overdoses, the lack of a formal mechanism for medical examiners to share death related to drug overdoses, and numerous disparate data collection processes. The absence of a comprehensive data collection program or formal communication structure has made it difficult to demonstrate the need for a comprehensive, well funded, and collaborative plan to combat the effects of this ongoing problem.

Drs. Hernandez and Nelson from the New York City Poison Center and New York University (NYU) School of Medicine published a paper suggesting that the under appreciation for the scope and depth of the drug abuse problem in New York state is due to the absence of unified terminology when collecting data, a lack of documentation around whether the drugs were obtained for medical or non-medical uses, and a lack of "cause of death collaboration" between poison centers toxicologists and medical examiners.[136] This finding may be extrapolated to other areas of the county as well.

Not only is there a lack of sharing of data but there are duplications in effort around data collection and the time from collecting the data to publishing the data may be lagged up to two years. A study conducted by the Illinois Poison Center looked at opioid cases from 2002 through 2007 showing indicators of the impending epidemic involving heroin laced with fentanly. These researchers concluded that if a system had be in place for trained poison center staff to identify, document, and report these cases there would have been a faster community response, fewer deaths, and data published weeks before the CDC reported on this crisis.[137] This study demonstrates that it is essential that a course of action be implemented to close the gap on drug abuse intelligence and improve real-time responses. Poison centers are in a position to close this gap.

One data sharing initiative that involves poison centers is the Researched Abuse, Diversion, and Addiction Related Surveillance (RADARS) program. RADARS has several "arms" to its study and poison centers are part of one arm. On a weekly basis,

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[136] S. H. Hernandez, and Lewis. S. Nelson, "Prescription Drug Abuse: Insight into the Epidemic," *Clinical Pharmacology & Therapeutics* 88, no. 3 (2010): 316, DOI: 10.1038/clpt.2010.154.

[137] Lee S. Friedman, "Real-time Surveillance of Illicit Drug Overdoses Using Poison Center Data," *Clinical Toxicology* 47, no. 6 (2009): 574, DOI: 10.1080/15563650902967404.

cases that meet the inclusion criteria for this study are sent to a central repository for RADARS, and this data is analyzed around opioids abuse. Numerous studies are published each year, tracking the trends on opioid abuse using poison center data. RADARS studies help to drive prevention and awareness campaigns. They also provide tangible proof of a systemic problem and help validate supporting agreements when presenting a recommendation to policy makers.[138]

There are several approaches within the poison center enterprise that would address some of these challenges. One recommendation would be to educate health care providers on the importance of their toxicosurveillance activities, their partnership with the CDC on this initiative, and the large-scale implication. There should be a systematic effort to communicate the demonstrated benefits to these healthcare providers to engage them more effectively in case consultation. Standardizing the training to of staff across all poison centers in best coding practices would also help to ensure a more accurate and consistent picture from NPDS.

A more universal approach to ensure that the data is accurate and timely is with the linking of patient's electronic medical records with poison center's patient's database. Having access to a patient's electronic medical record (EMR) would allow for a poison center to have a more detailed case history to base management recommendations on, have specific exposure information to provide early warning messaging to other partners, and it would reduce the time a heath care provider spends on the relaying information to the poison center as opposed to providing direct patient care.

Admittedly, gaining access to each health care facility's EMR would be difficult. Numerous EMR platforms are utilized across the country, and training staff on each program would be equally cumbersome, requiring significant commitments of time and resources. Additionally, each staff person would need to complete a confidential training program for each hospital. A single system or the ability for a "reviewer" to access each

138 "Overview," RADARS System, 2012, accessed November 12, 2015, http://www.radars.org/home2/overview.

system via a single repository or data warehouse would make the data collecting and mining more accurate, timely and efficient

Another consideration in utilizing EMRs to obtain patient history is that it minimizes the interaction between the health care provider and the staff of the poison center. Media rich theory suggests that face-to-face or direct communication is more optimal than indirect communication, such as obtaining information from a database.[139] A question to consider before exploring the widespread access to an EMR is: will this reduce the opportunity for collaboration between poison center staff and health care providers and will this decrease their utilization of poison centers as a resource? Working closely with local responders would help to ensure that this does not happen.

Once the data is collected, the next challenge is sharing the data. There are numerous agencies collecting intelligence but there is limited ability to cross reference and validate information. In addition, there are no protocols in place to ensure the quality and accuracy of the data collected or of the subsequent actions taken. The development of a cohesive nationwide effort to collect this data would be beneficial. Poison centers are in a position to take the lead on this effort. To do this, there are several steps and changes needed, including mandatory reporting.

Developing collaboration between poison centers and agencies with the Department of Homeland Security would provide another outlet for poison centers data to be shared; this may expedite the identification and response to an emerging threat. It would be advantageous for DHS to have a partner with close local ties to HCFs, first responders, the media, as well as a community presence for the general public.

Expanding the relationship and initiatives with the CDC and poison centers beyond drugs of abuse, carbon monoxide, and other chemicals to biological threats, such as influenza and Ebola, would be advantageous as well. It is these types of threats that poison centers turn to the CDC for direction in case management, and in turn, poison

[139] Richard Bergin, "Media Richness Theory," Naval Postgraduate School video, 20:00. https://www.chds.us/coursefiles/IS4010/lectures/tech_media_richness_long/story.html. Internal CHDS website.

centers are able to track the new and emerging threats around diseases, drugs, and consumer products in real time.

A recommendation for the state level would be to initiate a comprehensive state data collection process around drugs of abuse cases to provide accurate and timely intelligence to legislators and policy makers. Networking and building trust at local and state levels may influence health care providers to call and report their cases routinely. Of course, this is limited to a poison center's catchment area and does not have national impact.

Each of these recommendations has the potential to increase poison center utilization for situational awareness. It is this information that has provided fodder for drug abuse legislation on both at state and federal levels, been instrumental in getting companies to change their product packaging, and influenced the development of safety measures within certain industries.

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IV. COMMUNICATION

A. OVERVIEW

One of the most important factors in working through a disaster is the ability to communicate information that is timely, accurate, and delivered in a focused manner. Poison center staffs must be comfortable communicating with professionals from various disciplines including, but not limited to, those from nursing and medicine. On a given day, they engage in conversation with health care providers within their own host institutions as well as from those in their catchment area. Interactions also take place with the general public, the media, and each other. Having the ability to communicate clearly, accurately, and under duress is a daily challenge. In the following sections, communication expectations and challenges are discussed as it relates to these varying professions and professionals.

B. PARTNERS

Poison center staff manages poisonous exposures in concert with other health care and public health professionals. Interoperability and collaboration is essential during an emergency so that critical information may be exchanged between all responding agencies. The following are examples of those agencies and professionals that poison center staff work with during emergency and during normal operations.

1. Health Care Providers

A poison center's staff communicates critical information during emergent situations. One interaction that happens with great frequency is that between poison centers staff and the staff of health care facilities. As there is no mandated requirement for hospital staff to call a poison center, the decision to call a poison center is based on

the need for assistance in assessing and treating a patient. The initial interaction between poison center staff and hospital staff is usually through the emergency department.[140]

There are three scenarios that are common to all poison centers when managing a patient in an emergency department, a patient that they are referring into an emergency department, or a patient that has been admitted to the hospital. These scenarios include the CSPI calling the emergency department (ED) and alerting staff that a patient is coming in to be evaluated. Poison Center staff may take a call from a registered nurse, physician, or physician extender from a health care facility (HCF) altering them that a patient has arrived in their ED and they may be asking for management recommendations

Poison Center staff also follow up on patients to determine their condition, what treatment was received and if additional care recommendations are needed. The follow up call may be made to the ED, intensive care unit (ICU), or medical floor.[141]

The CSPIs base their management recommendations to HCP or to the person calling from home on the information provided to them. They are dependent on the caller whether she or he from the general public or from a hospital. This exchange of vital information via the telephone requires good communication skills, good assessment skills, and the ability to recognize and discern warning signs. CSPIs, like their colleagues who work on other nursing triage lines, are impacted by their own experiences, judgments, and biases when determining the level of toxicity and severity of outcome of their patients.[142]

How effectively they perform this task and the ability to extrapolate these results to how they would perform during a disaster has been evaluated in several research projects. The results were variable. Cummins et al. interviewed staff from a poison center

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[140] Mollie R. Cummins et al., "Electronic Information Exchange between Emergency Departments and Poison Control Centers: A Delphi Study," *Clinical Toxicology* 50, no. 6 (2012): 503, DOI: 10.3109/15563650.2012.693183.

[141] Mollie R. Cummins et al., "Inefficiencies and Vulnerabilities of Telephone-Based Communication between U.S. Poison Control Centers and Emergency Departments," *Clinical Toxicology* 51, no. 5 (2013): 437–438, DOI: 10.3109/15563650.2013.801981.

[142] Rebecca Poynton et al., "Specialist Discrimination of Toxic Exposure Severity at a Poison Control Center," *Clinical Toxicology* 47 (2009): 681, DOI: 10.1080/15563650903140407.

and two major HCFs that were not directly affiliated with the poison center but utilized the poison center for case management information. The results from their study showed some challenges that needed addressing and had the potential to impact patient outcomes. Some of these challenges were the failure of the health care provider to present a clear clinical picture to the CSPI that included specific details such as laboratory results or clinical symptoms. In some cases, the exchange of clinical information was through a third party that had no medical background. On many occasions, the patient was discharged, transferred to another facility, or the patient left against medical advisement (AMA) prior to the poison center calling and obtaining their medical outcome.[143]

Equally problematic is when multiple patients present to an emergency department with a similar exposure, as would happen during a disaster, and the CSPI is given general information and not patient specific information. The health care provider may think it expedient to talk about symptoms and treatment in general terms, and the CSPI is then challenged with providing accurate and safe information in light of the fact that people react differently to the same exposure based on route, duration, age, and pre-existing medical conditions.[144]

2. EMS

In a study conducted by Martin-Gil et al., first responders stated that poison centers are their first choice as a resource for treatment recommendations for antidotes and for decontamination guidelines. The results of this study reinforce the importance of maintaining close communication with EMS through training, disaster drills, and planning as well as reinforcing the accessibility and credibility of poison center staff. Fostering this relationship will increase the likelihood and much-needed, effective, and consistent communication during a disaster. Table 1 provides more detailed information on what information EMS look for when contacting a poison center.[145]

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143 Cummins et al., "Inefficiencies and Vulnerabilities of Telephone-Based Communication," 440.

144 Ibid., 442.

145 Ibid.

Table 1. Reasons for EMS call to a Poison Center[146]

Information Requested	EMS Response
Chemical identification	52.6%
Treatment recommendations	74.1%
Antidotes	59.5%
Protective gear	56.9%

Source: Christian Martin-Gill et al., "Poison Centers As Information Resources For Volunteer EMS In A Suspected Chemical Exposure," *The Journal of Emergency Medicine* 32 (2007): 399.

3. General Public

During a disaster, calls come into a poison from the general public. It is the responsibility of the CSPI to direct callers to the appropriate level of care, allay some of their anxiety, and answer their questions. CSPIs do this as part of their routine work each day. Ellington et al. defined four approaches used by CSPI's when dealing with these types of calls. They are "informational, facilitative, planning, and emotional."[147]

The facilitative approach appears to be the most common and involves information gathering, with the CSPI asking questions and the caller providing detailed information. The next common approach is the informational. During this phase of the dialogue, the CSPI is giving information and the caller is asking numerous questions but very little detailed information is provided to the CSPI. The next approach is planning. In these calls, the CSPI establishes a rapport with the caller while collecting critical information and providing guidance. The final and least often demonstrated interaction is

[146] Christian Martin-Gill et al., "Poison Centers as Information Resources for Volunteer EMS In A Suspected Chemical Exposure," *The Journal of Emergency Medicine* 32, no. 4 (2007): 399, DOI: 10.1016/j.jemermed.2006.06.011.

[147] Lee Ellington et al., "Communication Patterns for the Most Serious Poison Center Calls," *Clinical Toxicology* 49, no. 4 (2011): 319, DOI: 10.3109/15563650.2011.569932.

Ellington et al. also looked at the determinants for which communicational style is employed. Their findings provide some useful information on future communication training for CSPIs. During a three to four minute conversation with a caller, 25 percent of their interaction is focused on obtaining information, and 25 percent is in the assessment and discussion around clinical effects. A smaller percentage of time is spent on building a rapport and connecting on an emotional level with the caller, and an equal amount of time is spent on making management recommendations.[149]

During the types of interactions where there is heighten anxiety and concern, one of the most effective ways to ensure that the caller follows the recommendation provided is to establish a sense of understanding and trust with the caller. This study suggests that individual CSPIs are predisposed to an approach based on their communication style. Some CSPIs are more comfortable and able to adjust their style based on the approach and needs of the caller. The ideal approach as reported by Ellington et al. is the planning approach in combination with the facilitative approach. With both of these approaches, there is an opportunity for relationship building while directing optimal care.[150]

How to measure poison center utilization or lack of utilization has been an ongoing problem faced by poison centers since the inaugural center was established. For many years, penetrance or the number human exposure calls received by the poison center per population of a given county in that center's catchment area was a major criterion in determining if a poison center should be accredited.[151] Poison center staff members have taken a critical look at the value of penetrance in light of the confounding factors that influence this calculation. These factors include proximity of the center to the county being evaluated, population mix of children verses adults, and degree of education outreach per county.

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[149] Ibid., 321.

[150] Ibid.

[151] Toby Litovitz et al., "Determinants of U.S. Poison Center Utilization," *Clinical Toxicology* 48, no. 5 (2010): 455.

Litovitz et al. looked at case data entered into NPDS and calculated penetrance per call center's catchment area. The research showed that there were geographical variations, as well as those of race, income, educational level, language and how far the area was from the poison center that impacted utilization. Areas with high penetrance had a high population of children, overall greater population base, Asian Americans living in the area, residents with high income and educational background, and a strong poison prevention outreach program.[152]

These finding were validated in subsequent studies as well. A survey was conducted from November 15 to December 7, 2011, to determine how aware callers were of the toll free number and services provided by a poison center. Callers where randomly selected and included individuals 18 years of age and older. Of the respondents, 41 percent used cell phones as their primary phone while five percent had landlines.

A similar survey was conducted in 2006 and some of the results were compared.[153] In the 2011 survey, there were 2,000 participants. Of the participants, 1,363 identified themselves a white, 233 as African Americans, 280 as Hispanics, and 127 as other. A little more than half were women. The largest age cohort was 45–64 years of age, and the smallest was 18–24 years of age. A little more than half had some college or more education, and the remaining respondents had high school or less education. A summary of the questions in this survey include:

- Had they contacted a poison center during the previous year?
- Given a set of scenarios would they call a poison center?
- Do they know the poison center number?

The results of the study indicated that there is a need for additional awareness education for some high-risk populations, and this can be extrapolated to include disaster scenarios as well. Those individuals who identified themselves as white, those individuals with children in the household, or those individuals between the ages of 25

152 Ibid.

153 StrategyOne, "Poison Help Campaign General Population Survey: Findings from the Poison Help General Population Survey," 2012, http://poisonhelp.hrsa.gov/the-poison-help-line/campaignfiscalyear2012.pdf, 4–5.

and 44 were the most knowledgeable of the Poison Help Campaign. Over 70 percent of the respondents knew that poison centers are available 24/7, that there is no utilization cost, and that language lines are available. The majority of the callers were unaware that this was a confidential service. Some thought that social service agencies, police, and insurance companies were privy to caller information.[154]

In the case of a poison emergency, most respondents stated that they would contact 911 but for general information they would call a poison center. A significant finding was that respondents over 65 were not aware of poison centers capabilities as compared to those who had children under the age of five. It is this last group that stated they would be more likely to contact a poison center.[155]

A smaller study was conducted within the state of Arizona to evaluate the differences between poison center utilization in rural areas as compared to cities. This study queried respondents that were 18 years old and over regarding their knowledge of poison centers. Results of this survey showed that women who did not identify as black or Hispanic and who had children had greater knowledge of poison centers as compared to African American and those people who selected Spanish as their primary language, regardless of gender, who were least likely to call a poison center.[156] These findings suggest that race and spoken language may be significant factors is poison center utilization.[157]

There are many contributory factors for the lack of utilization of poison centers among African Americans and Latinos. They include language barrier, fear of retribution—including reporting to the department of social services—and distrust of perceived government agencies. Kelly et al. developed an educational tool in the form of a video that they presented to a group of Spanish speaking mothers at a Women Infants

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154 Ibid., 12.

155 Ibid., 18.

156 Onyinye Otaluka et al., "A Survey of Poison Center Knowledge and Utilization among Urban and Rural Residents of Arizona," *Toxicology Reports* 2 (2015): 203, DOI: 10.1016/j.toxrep.2014.12.001.

157 Ibid., 204.

and Children (WIC) clinic. They provided no additional education but did give each participant information packets that included the poison center's toll free number. After the viewing of the video, there was increased interest in poison centers.

This lent itself to the next study, which incorporated the video and poison prevention education into 60 parenting education classes for parents who were economically challenged and for whom English was not their first language.[158] Attendees were surveyed prior to the class and then within a month after the class. The results of this study showed improvement in poison center awareness, ability to provide poison center phone number, and appreciation that some poisonings are safely managed at home with poison center staff assistance.[159]

Each of these studies has implications for disaster response efforts. Much of what these studies revealed was that populations with challenges such as language or people who are new to a community are the least likely to reach out to a poison center for help. This is concerning during times when efforts are made to reduce unnecessary emergency department visits to minimize the spread of a disease, when resources are limited and need to be conserved, and when post-disaster travel is restricted due to a state of emergency.

4. Media

Poison center staff work with the media on a daily basis in a role that is similar to that of a public health information officer. This is applicable during a disaster as well. They need to get the information out to the public regarding emerging trends and immediate issues of concerns. Forming strong collaborative relationships with the media has numerous positive benefits. This was a recommendation from a panel of 26 professionals from emergency management, communications, and public health who convened to discuss the role of a PHI and the media during a disaster. Other

158 Nancy. R. Kelly et al., "A Randomized Controlled Trial of a Video Module to Increase U.S. Poison Center Use by Low-Income Parents," *Clinical Toxicology* 52, no. 1 (2014): 57–58, DOI: 10.3109/15563650.2013.863328.

159 Ibid., 58, 61.

recommendations from this group included honing communication skills between both professionals and inviting representatives from the media to participate in drills.[160]

In acknowledgment of the power of the media, HRSA's Poison Help Line initiatives relies heavily on the media to provide ongoing message regarding poison center's scope of function, accessibility, and its national toll free phone number.[161] In HRSA's 2012 report to Congress, HRSA illustrated several media-focused initiatives, including the development two national public service announcements (PSA), eight radio PSAs in English and Spanish, and eight news articles in both languages. In addition to these efforts, HRSA also launched two websites: www.PoisonHelp.hrsa.gov and www.PoisonHelpEspanol.hrsa.gov.

The influence of media has been considered in light of a disaster as well. For instance, LoVecchio researched the impact the media had on poison center calls after September 11, 2001, specific to the month prior to September 11, 2001 and querying for anthrax as the exposure. As predicted, no calls had been received by the poison center regarding anthrax during that timeframe. LoVecchio then queried for anthrax after September 11 and found one call in September, 201 in October, 79 in November, and 10 in December. The calls increased after the anthrax fatality was reported on October 6, 2001.[162]

The study of Kittler et al. looked at the responses from a survey conducted in 2001 of 500 patients from an ambulatory clinic in Boston. The study showed that of the 209 participants, over 75 percent obtained information regarding anthrax from the media.

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[160] Wilson Lowrey et al. "Effective Media Communication of Disasters: Pressing Problems and Recommendations," *BMC Public Health* 7, no. 97 (2007): 99–102.

[161] U.S. Department of Health and Human Services Health Resources and Services Administration, *Report to Congress: Poison Help Campaign*, 2012, http://poisonhelp.hrsa.gov/the-poison-help-line/campaignfiscalyear2012.pdf, 1–13.

[162] Frank LoVeechio, "Letter to the Editor: Media Influence on Poison Control Volume after 11 September 2001," *Prehospital and Disaster Medicine* 19, no. 2 (2004): 185.

However, these same respondents rank media third as a reliable source as compared to their own physicians and Internet sources respectively.[163]

Poison centers need to take in to consideration the power of social media. There are well-documented examples of how social media has positively impacted the general public as well as community responders.[164] One example is in 2004 when public health professionals utilized Twitter to direct people on where they should go to receive the H1N1 vaccination. Some staff went as far as to text pictures during events to reveal locations and document activities.[165]

5. Colleagues

Poison centers appear to have good communication skills when working with customers and stakeholders. Crouch et al. conducted a study accessing how well poison center staff communicate with each other work. In this study, 537 poison center staff from centers nationwide were administered a series of survey questions asking them to rank how important collegial communication was to them as it relates to a positive work environment. They were also asked if communications within the center were distracting, what those distractions where, and if it impacted performance. Participants in this study were comprised of a multidisciplinary array of staff including CSPI's, managing directors, medical directors, and educators. Results revealed that the majority of the respondents ranked collegial communications as very important. An interesting finding was that while the majority of the CSPIs did not find communications distracting, 42 percent ranked them as distracting on a moderate or greater level.[166] The types of distractions noted were high noise level due to space limitations, cell phones and loud voices, and ineffective and critical dialogue among co-workers. Participants also noted

163 Anne F. Kittler et al., "The Internet as a Vehicle to Communicate Health Information During a Public Health Emergency: A Survey Analysis Involving the Anthrax Scare of 2001," *Journal of Medical Internet Research* 6, no. 1 (2004): 4–6.

164 Raina M. Merchant, Stacy Elmer, and Nicole Lurie, "Integrating Social Media into Emergency-Preparedness Efforts," *New England Journal of Medicine* 365, no. 4 (2011): 291.

165 Ibid., 290.

166 B. I. Crouch et al., "The Importance of Interpersonal Communication in Poison Centers," *Clinical Toxicology* 51, no. 9 (2013): 893–94, DOI: 10.3109/15563650.2013.841913.

ineffective communication between CSPI and administrative staff and difficult callers as a distraction.[167]

C. ANALYSIS AND RECOMMENDATIONS

The majority of Americans witnessed the horrors of 9/11 on their televisions; survivors of disasters like hurricanes obtain updated information from radio and television that come from worldwide reports that keep all of us informed of earthquakes, bombings and the like.[168] The impact that media had on individual behavior was described in Boston study found in Section B 4, Media, discussed earlier. This study and anecdotal evidence confirms that it is essential for poison centers to use the power and influence of the media to ensure that complete and accurate information is provided to the public during a disaster.

Relying on past collaborations, the poison centers staff should be accessible as a resource for the media. They should provide them with the information and talking points in order to allay the public's fear and reduce inaccuracies and sensationalism. Efforts to enhance communication would optimize poison center effectiveness. Their established relationship with the staff of departments of health, healthcare facilities, emergency medical personnel, as well as the media will help to facilitate productive communication during acrisis situation and enhance interoperability during a crisis and normal operations.[169]

Widening the communication channels to include federal partners would have the potential to enhance communication, but poison centers' communication capabilities appears more valuable on a local level. HCPs are more apt to follow recommendations from a poison center is they have a trusted relationship with their local toxicologist and poison center staff.

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[167] Ibid., 895.

[168] Lowrey et al. "Effective Media Communication of Disasters," 98.

[169] Lehman-Huskamp, and Scalzo, "Acute Disaster Response: Lessons Learned," 4.

Disaster response happens first and, hopefully, effectively on a local level. The potential to impact high-risk population is more likely to happen by building trust in communities prior to a disaster occurring. Preexisting relationships, such as those with the media and HCP, are nurtured on an ongoing basis this helps to facilitate communication during a disaster.

There are clear examples of challenges as well. Some populations were found to be reticent in using poison center services. This was especially problematic in high-risk neighbors and with high-risk populations during a disaster. Expanding the current partnership between poison centers HRSA and the Center for Disease Control should be a priority. HRSA's awareness and educational efforts around the creation and promotion of the 1-800-222-1222 phone line has increased poison centers' visibility. The public service announcements, previously described in Chapter IV, Section 4, Media, demonstrate a commitment to promoting poison centers and ensuing accessibility to all.

Expanding the current relationships with the CDC and HRSA provides additional opportunities for poison centers to provide clinical expertise and situational awareness to those entities in the community that look to the CDC for guidance around medical emergencies, including HCPs, public health officials, and the general public.

Building on HRSA's Poison Helpline ensures that the general public has the poison center's helpline number available and understands that poison centers are viable resource during a disaster. There needs to be additional awareness efforts pertaining to this messaging. These efforts need to be especially focused on high-risk populations that have no knowledge or limited knowledge of poison centers. Poison centers' capability to respond to callers with a hearing or language challenges needs to be included in all awareness campaigns.

Inter-collegial communication needs to be addressed as well. Concerns raised from Crouch's study, as discussed in Section B 5, Colleagues, such as noise level and distractions in the workspace, will only increase during call surges associated with a disaster. Use of remote staffing will reduce the number of people in the office as well as call sharing from one center to another.

Collegial communication between poison centers also needs to be considered. Poison centers have a long history of sharing information and data from center to center. This was evident with the emergence of "bath salts" and the laundry pods as described in the Chapter III, Surveillance. Poison center staff became alerted to these issues when the managing and medical directors from the poison center that first recognized the problems and emailed their colleagues to share this information.[170] It was due to their clinical expertise that they were able to recognize a problem and then communicate it to their colleagues. There should be ongoing efforts around collaborating and information sharing.

[170] Scharman, "Liquid 'Laundry Pods,'" 725.

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V. CLINICAL EXPERTISE

A. OVERVIEW

Poison center staff members have a unique expertise, and an ability to share this knowledge 24/7. All recommendations made are evidenced based. Staff not only triage incoming calls but they provide ongoing follow-up consultation on those patients treated in a hospital.

B. STAFF

Poison Center are staffed with professionals from various clinical and educational backgrounds. Each specialty brings their own unique expertise to a center and provides for a multi-layered approach to managing and preventing poisonings. A more detailed explanation of the different types of staff and their clinical expertise is provided in the following section.

1. CSPIs

CSPI's are on the "frontline" of poison centers. They provide triage, case management, and follow-up support of non-toxic to highly toxic exposures each day. Their clinical expertise may vary based on their educational background, their poison center training and years of experience.[171] CSPIs must quickly assess a patient's symptoms over the phone, provide clear directions to non-health care providers for home based calls and evidenced based recommendations to health care providers.[172] They always have as a back-up resource a medical or clinical toxicologist to review cases with to help them make management recommendations particularly for hospital based cases.[173]

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171 Institute of Medicine Committee, *Forging a Poison Prevention and Control System*, 123.

172 Cummins et al., "Electronic Information Exchange," 504; Poynton et al., "Specialist Discrimination of Toxic Exposure Severity," 670.

173 Institute of Medicine Committee, *Forging a Poison Prevention and Control System*, 125.

2. Toxicologists

A paper written by members of the AAPCC Taskforce from September 2010 describes the role of a poison center's clinical toxicologists as that of a "virtual toxicologist" for the health care providers calling for a consultation regarding their poisoned patient. Physicians and physician extenders, particularly in rural areas, depend on the expertise and resources provided to them by poison centers.[174] This level of knowledge can be valuable during times of crisis and when getting accurate medial information is time sensitive.

There is documented evidence that the clinical expertise of the poison center staff impacted patient outcomes and impacts utilization of health care resources. For example, the clinical knowledge of a toxicologist would prove useful during a nuclear power plant emergency. They would not only be able to provide management guidelines on radiation exposures but would also be able to develop educational material for both the public and for health care providers.[175]

Poison center staff are always looking for opportunities for continuing education and collaboration. The CDC hosted a round table exercise in Atlanta Georgia to evaluate and educate poison center staff on how to respond during a radiation emergency. A general email was sent out across the AAPCC membership inviting staff to participate. There were 36 attendees including medical toxicologists, clinical toxicologists, and CSPIs.[176]

This exercise provided an opportunity to discuss what the role poison centers play during such an emergency and what challenges might hinder their efforts. Attendees proposed they would play a key role in case management, serving as a point of information distribution, as well as data collection. They also expressed concerns about their limited knowledge and experience in radiation emergencies and said they would

[174] Poison Center Task Force, "Poison Centers: An Information Paper," 2.

[175] Z. N. Kazzi and C. W. Miller, "The Role of Toxicologists and Poison Centers during and after a Nuclear Power Plant Emergency," *Clinical Toxicology* 51, no. 1 (2013): 1, DOI: 10.3109/15563650.2012.757319.

[176] Center for Disease Control and Prevention, *Radiation Emergencies*, 5.

require additional training as well as management guidelines in order to feel better prepared to respond to this type of emergency. A suggestion that came of this exercise was that poison centers need to increase their collaboration on a state and federal levels, including agencies such as Radiation Emergency Assistance Center/Training Site (REAC/TS)[177] and radiation programs.

C. ANALYSIS AND RECOMMENDATIONS

Poison center staff not only detected and reported on the emerging trends but also provided lifesaving medical recommendations. This was shown with the emerging synthetic marijuana trend, not only was data sought to substantiate the growing concern, but their clinical expertise was solicited by health care providers caring for these patients. One explanation for the increase in health care facilities calling for management recommendations for these cases may be that the presentations were more intense that what was expected with cannabis and that the HCP had little or knowledge of the toxicity of this drug.[178]

How effectively a CSPI manages a poisoning may be predicated on their level of experience with a given agent. Poynton et al. conducted a study at a large U.S. poison center examining how CSPI's predict patient outcome as compared to the actual patient outcome. This study was conducted over a period of 13 months and included input from 13 CSPIs with varying backgrounds, including pharmacists and registered nurses. The results confirmed previous studies that demonstrated a tendency to predict accurate outcomes when the nature of the exposures produced mild symposiums as compared to a decrease in ability to accurately predict outcomes from more serious exposure cases.[179] The reason behind these results may be related to CSPI experience and frequency in dealing with calls of low toxicity as compared to those of high toxicity. This may be

177 Kazzi, and Miller, "The Role of Toxicologists and Poison Centers," 2.

178 Forrester et al., "Synthetic Cannabinoid and Marijuana Exposures," 1009.

179 Poynton et al., "Specialist Discrimination of Toxic Exposure Severity," 681.

problematic during a disaster, when the CSPIS are faced with an unusual, unfamiliar, and high toxic substance.[180]

An example where the utilization of poison center's staff's expertise would have positively impacted outcome was in a study conducted by the Illinois Poison Center. The researchers from this center looked at opioid cases from 2002 through 2007, which showed indicators of the impending epidemic involving heroin laced with fentanly. These researchers concluded that if a system had been in place for trained poison center staff to identify, document, and report these cases, then there would have been a faster community response, fewer deaths, and published data weeks before the CDC report on this crisis.[181]

Poison centers need to be involved consistently around public health concerns such as the growing drug abuse trend. Collaborating within a national platform will help increase their visibility. For example, a more integrated relationship with emergency management would only enhance the relationship with poison center and strengthen their role in planning and response.

[180] Ibid.

[181] Friedman, "Real-time Surveillance of Illicit Drug Overdoses," 578.

VI. REDUCING THE BURDEN ON HEALTHCARE FACILITIES

A. OVERVIEW

The primary mission of poison centers is to "*decrease the morbidity, mortality and cost related to poisonings*."[182] To do this, poison centers use multifaceted approach that includes the engagement of competent staff, 24/7 triage services, poison prevention initiatives, collaboration with other agencies, and focused efforts to eliminate unnecessary health care utilization.

B. HEALTH CARE COSTS

A study conducted by the Lewin Group suggests that poison centers realize a cost savings by reducing unnecessary emergency room visits and patients' length of stay. The results were calculated and demonstrated 1.8 billion dollars in savings or a return on investments of $13 per dollar invested in poison centers.[183] Table 2 provides a detailed breakdown of annually cost savings attributed to poison center utilization for a poisoning.

Table 2. Health Care Cost Savings per Year Based on Utilization[184]

Cost Savings (in millions)	Reason
$753	Unnecessary health care visits
$441	Prevention outreach
$23	Decreases length of stay
$603	Days out of work

Adapted from: The Lewin Group, *Final Report on the Value of the Poison Center System*, ii.

182 *Statement by Marsha Ford, Regarding the Reauthorization of the Nation's Poison Control Center Law; Before the Subcommittee on Health of the Committee on Energy and Commerce; United States House of Representatives Hearings on 'Examining Public Health Legislation to Help Local Communities* (2013). https://aapcc.s3.amazonaws.com/files/library/Marsha_Ford_Reauth_Congressional_Statement.pdf.

183 The Lewin Group, *Final Report on the Value of the Poison Center System*, ii.

184 Ibid.

CDC's 2010 fatality report indicated that over 40,000 drug related deaths occurred inclusive of poisonings and drug abuse causes.[185] In addition, Friedman et al. looked at the role poison center consultation from health care facility staff impacted patient outcomes and their length of stay relative to a poison exposure. Their study reviewed 9,936 hospitalizations across 186 hospitals in the Illinois poison center's catchment area.

Friedman et al. conducted a comparative analysis looking at two groups with the same diagnoses of suicide attempts using a single drug or combination of drugs and non-drug products. The authors compared the medical outcome between those cases in which a poison center was consulted for management recommendations and those that did not. The researchers limited the study to inpatients in a health care facility that also had an emergency department as their entry point for admissions. The International Classification of Disease codes (ICD) were utilized to determine diagnosis.[186]

The results showed 0.5-day decrease in length of stay (LOS) for those cases where a poison center was consulted and an overall reduction in health care costs based on a longitudinal analysis of all patients admitted with that diagnosis. LOS was adjusted down from 1.5 days to the reported 0.5 days based on several factors, including that patients in the consultation group were younger and had less co-morbidities than those in the group that did not receive a consultation.[187]

A 2008 article published by LoVechio et al. similarly demonstrates cost savings after consultation with a poison center, but this study looks at home rather than a health care facility as site of caller. In this study, staff from a poison center conducted a survey from February 1 to April 1 of 2007 asking callers what they would have done in the event there had been no poison center to contact for their poison exposure. A total of 600

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[185] Sherry L. Murphy, Jiaquin Xu, and Kenneth D. Kochanek, "Deaths: Final Data for 2010," *National Vital Statistics Reports* 61, no. 4 (2013): 11, http://www.cdc.gov/nchs/data/nvsr/nvsr61/nvsr61_04.pdf.

[186] Lisa S. Friedman et al., "The Association between U.S. Poison Center Assistance and Length of Stay and Hospital Charges," *Clinical Toxicology* 52, no. 3 (2014): 199, DOI: 10.3109/15563650.2014.892125.

[187] Ibid., 201.

responses were solicited with 37 percent indicating they would have called for an ambulance, and 33 percent would have gone directly to an emergency department by private vehicle. Only those callers that had exposures that did not require referral into a health care facility were excluded from this survey. The authors posit that 70 percent of the callers would have been treated in an emergency department. They extrapolated these results to the 41,262 human exposure calls that the poison center received in 2007 and calculated that there would have been 28,883 patients that sought medical treatment in a hospital unnecessarily. They then look at the average cost for these 28,883 patients and determined that $33,270,000 in health care cost was saved by their poison center.[188]

There have been numerous studies conducted over the last five years looking at the cost effectiveness of poison centers. Galvao and Silva reviewed over 422 such studies from June 2010 to November of 2011. They determined from the 422 studies, only nine met their inclusion criteria. Of these nine studies, seven focused on U.S. poison centers and each one demonstrated cost savings attributed to poison center consultation. The cost savings ranged from 0.76 to 36 dollars saved as compared to every dollar expended on poison centers.[189] In addition the study by LoVeccchio et al. described in the previous paragraph, demonstrates the highest rate of cost saving at $36 saved.[190]

Each of these studies has implications as health care cost continues to escalate. A past president of the AAPCC, Marsha Ford, addressed the Subcommittee on Health of the Committee on Energy and Commerce regarding the monies spent on unnecessary medical expenses. She stated that in 2009, the amount was in excess of 200 billion dollars.[191] This number will not only escalate over time with raising health care costs but will increase during times of disasters as well.

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188 Frank LoVecchio et al., "Poison Control Centers Decrease Emergency Healthcare Utilization Costs," *Journal of Medical Toxicology* 4, no. 4 (2008): 222–23.

189 Tais F. Galvao et al., "Economic Evaluation of Poison Centers: A Systematic Review," *International Journal of Technology Assessment in Health Care* 28, no. 2 (2012): 90, DOI: 10.1017/ 50266462312000116.

190 Ibid., 89.

191 *Statement by Marsha Ford, Regarding the Reauthorization of the Nation's Poison Control*, 1.

C. ANALYSIS AND RECOMMENDATIONS

There are benefits to minimizing the burden of unnecessary emergency department visits during a disaster and during normal operation that have been demonstrated by numerous studies quantifying the cost savings. An example was presented in Chapter II, Section B 2, Intentional Biological and Chemical Exposures. Poison centers where able to respond to and allay the public fears around anthrax poisoning and thereby reduce the number of people that would have sought unnecessary medical care in an emergency department.

This was also the case with the West Virginia case study, presented in Chapter II, where the poison center handle over 700 calls related to the Freedom Industries chemical spill. By providing triage support to these callers over the phone, the poison center reduced calls and visits to the local health care facilities and health care providers. Additional supporting evidence was provided in the Lewin Group's published report in 2012, which not only demonstrates cost savings for unnecessary ED visits, hospital admissions, LOS but also days of work. A summary was provided in Table 2.

In addition to evaluating cost savings with the use of poison centers is an attempt to evaluate their effectiveness of service quantitatively. The prevailing tool used to measure the effectiveness of a poison center's service, as discussed in Chapter IV, Section 3, General Public, is calculating the penetrance for each county served. Penetrance is calculated based on the population of an area and the number of exposure calls received from that area adjusted for 1,000. The lower the penetrance the fewer number of calls has been received by that area, and conversely, the higher the penetrance, the greater number of calls received. This calculation has been included in the accreditation process as a determinant of how successful a poison center is in reaching its constituents. It is also used when strategizing poison center's outreach educational efforts. This approach does have some limitations however as a larger number may be reflective of more focused prevention efforts in that area and a smaller number may be due to a smaller pediatric population in that county.[192]

[192] Litovitz et al., "Determinants of U.S. Poison Center Utilization," 449.

When a disaster occurs, FEMA responds and facilitates the dissemination of resources, and partnering with poison centers would impact the distribution of necessary versus unnecessary medical supplies, such as antidotes. Poison centers would have the capabilities to perform triage, consult on anticipated severity of symptoms, and long-term prognostic indicators. One example is with carbon exposure after Hurricane Sandy. Poison center clinical staff would have been able to assessment on the need for exposed patient to receive hyperbaric treatment.

The current relationship with HRSA and the CDC has impacted penetrance through the extensive marketing and advertizing of the national 800-222-1222 poison helpline number. Further expansion of these efforts to include promotion within the healthcare community would increase awareness and potential utilization by healthcare providers.

Having a strong collaborative relationship within the poison catchment area includes 911 centers and first responders. When a caller calls 911, and the 911 dispatcher consults with a poison center before dispatching a rig, it results in fewer transports to an emergency department. Likewise, when a first responder calls from the scene, the call may result in the patient remaining at home if the poison center staff determines that the exposure is non-toxic. As demonstrated in the LoVeecho study there are cost savings that result from poison center's intervention in reducing unnecessary medical interventions.

Another benefit from EMS calling from the scene is that if the patient does need to be transported to a HCF, poison staff is able to provide initial recommendations to them as well as the opportunity to gather from them, pertinent patient information to provide the receiving HCF. The poison center staff are then able to contact the HCF staff and alert them to an incoming patient and provide them with initial management recommendations.

Greater utilization of poison centers by 911, physicians, and first responders would directly impact when and how a patient is transported to a hospital as well as their course of treatment and stay. This is applicable during a disaster by providing the phone triage service as well as with toxicology case consultations, thus decreasing the number of unnecessary patient transports.

The CDC has led an effort around bring together poison center staff, members from the Council of State and Territorial Epidemiologists, and state health department representatives in the formation of the Poison Center and Public Health Collaborations Community of Practice (CoP). This committee convenes in order to share ideas around public health related issues, discuss initiatives, opportunities for partnering, and vet ideas around poison center's role in response to public health threats.[193]

There are numerous other federal and state agencies that have a focus on poisonings. Some of these agencies have partnered with poison centers. Table 3 illustrates how diverse and vast the efforts are. This is only a sampling of multiple agencies' efforts.[194]

193 "Poison Center and Public Health Collaborations Community of Practice," Centers for Disease Control and Prevention, January 13, 2013, accessed October 8, 2015, www.cdc.gov/nceh/hsb/chemicals/poison_center.htm.

194 Institute of Medicine Committee, *Forging a Poison Prevention and Control System*, 285.

Table 3. Agencies that Deal with Poisonings

Examples of Exposures	Responding Agencies
Pediatric and Adults Consumer Products and Medications	Center for Disease Control Consumer Product Safety Commission Safe Kids
Food and Drug Safety	Federal Drug Administration Department of Agriculture
Drugs of Abuse	State's Departments of Health, Substance Abuse and Mental Health Services Drug Enforcement Agency
Environmental toxins	Environmental Protection Agency Agency for Toxic Substance and Disease Registry
Occupational exposures	Occupation Safety and Health Administrations
Terrorism and Disasters	Department of Homeland Security Federal Emergency Management Agency Center for Disease Control

Adapted from: Institute of Medicine Committee, *Forging a Poison Prevention and Control System*, 285.

Each of these agencies and others could benefit from the data and expertise of poison centers staff. Expanding and including poison centers in their efforts would streamline efforts and maximize efficiencies.

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VII. IMPROVING OUTCOMES DURING A DISASTER BY LEVERAGING POISON CENTER'S CAPABILITIES

Research, case studies, and analysis of efforts demonstrated that poison centers provide a service to the public and professional community during times of normal operations and during a disaster. The previous chapters described what poison centers do well and where there are opportunities for improvement.

Despite of all of the efforts spanning a 50-plus year history, as stated in the IOM publication *Forging a Poison Prevention and Control System*, "***poison centers are in the room but not at the table***."[195] This is shortsighted as poison centers, as described in this paper, do positively impact outcomes during a disaster. They do not generate income, but they do save lives, reduce health care costs, and provide a unique and valuable resource to the public and professional community.

One explanation for their lack of presence at the "table" may be that even though there have long-standing attempts to solidify poison centers into a cohesive organization, there continues to be some disparate efforts among poison centers. Part of the reason may lie in the fact that there are different expectations by stakeholders and funders from poison center to poison center. Equally plausible is that poison centers are continually faced with budgetary concerns. Maintaining operations when funding is a challenge and shifts the focus from "how to collaborate" to "how to survive."

Efforts to expand poison centers' scope of function to increase utilization and stabilize funding has been impacted by staffing shortages, differences in staff training, differences in capabilities and lack of time. Some centers are more reticent to engage in activities that, at first glance, seem outside of the scope of toxicology then others. These difference manifest in a variety of ways and include: overall level of comfort in dealing with certain disaster, variations in how cases are coded and importance of coding, willingness to engage in partnerships, and forging partnerships on the local, state, and

195 Ibid.

federal levels. In addition, the lack of a universally agreed upon shared matrix for poison center unitization or health care cost savings has yet to be determined.

To more effectively contribute to disaster response, poison centers must promote what they have done and can do in a disaster. The American Association of Poison Control Centers and individual centers themselves need to partner with relevant homeland security and other officials to develop a strategic plan to fully utilize poison centers' capabilities in public emergencies. These strategies should include: (1) the expansion of collaborations with nontraditional partners including those outside of healthcare; (2) the provision of surveillance around all chemical, biological, radiological, nuclear, and explosives (CBRN) threats; and (3) the active engagement in disaster response and planning efforts

For there to be an impactful change to how poison center's capabilities are integrated into disaster response efforts at the local, state, and national levels during a disaster, these strategizes need to be adopted by all poison centers within the AAPCC membership. Some tactile first steps towards meeting this vision, based on this research, are summarized in Table 4.

Table 4. Recommendations Summary

Capabilities	Recommendations
Ability to response during emergencies-disaster	1. Develop formal relationship with FEMA and other DHS agencies 2. Engage on a local and state level on planning committees and drills.
Toxicosurveillance	1. Statewide regulation requiring that health care facilities contact their local poison center for all poisoning cases. 2. Begin discussion around poison centers gaining access to their hospitals electronic medical records. 3. Development of a state or nationally based repository for all drug abuse cases.
Accessibility and communication infrastructure	3. Expand partnership with CDC to include other public health threats 4. Expand on HRSA's Poison Helpline Campaign to for the general public to increase their utilization of poison centers
Ability to reduce unnecessary health care costs	1. Initiate a national awareness campaign directed at health care providers and other public health professional around the scope and function of poison centers.
Clinical expertise to impact patient outcomes	1. Standardize CSPI Training. 2. Include poison centers in statewide disaster planning and drills. 3. Encourage poison center staff to attend FEMA training opportunities. 4. Increase in the research efforts and publishing efforts around poison center's role in disaster response.

Developing a more formal and collaborative relationship within the Department of Homeland Security, increasing the partnerships with HRSA, the CDC, and increasing poison centers presences at the local, state, and national levels, will only strength the five core poisons center functions during a disaster.

Maintaining the relationship with HRSA and the ongoing promotion of the Poison Helpline will continue to increase awareness of poison centers capabilities. Efforts to expand this campaign to include target audiences such as law enforcement, emergency medical services, and public health professionals should be considered as well.

Building on the current relationship with the CDC around toxicosurveillance should continue to be a priority for poison centers as more agencies recognize the situational awareness function provided by the poison centers, the greater likelihood of utilizing this service as well as the other services they provide. Part of expanding this relationship should include surveillance and support, not just with pandemic flu and Ebola, but other public health concerns too. Exploration of these opportunities through the CoP initiative would allow for ongoing dialog around poison centers role in public health.

Disaster response would be greatly enhanced by collaborating with FEMA and other DHS departments. These partnerships would add visibility, creditability, and a national platform for poison centers; however, the impact of local and state planning and response cannot be overlooked. The initial and often most impactful response happen on this level. Early engagement with poison centers will enhance response efforts and mitigate some of the effects.

Our nation is confronted by threats that are manmade or natural on a daily basis. We need to stay vigilant in order to plan for, detect, respond to, and mitigate the effects of these threats. Poison centers to this on a daily basis. It is in the best interest of our communities to leverage the demonstrated expertise of our poison centers to enhance existing disaster response efforts. We need to do this to better safeguard the well being of all of us.

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